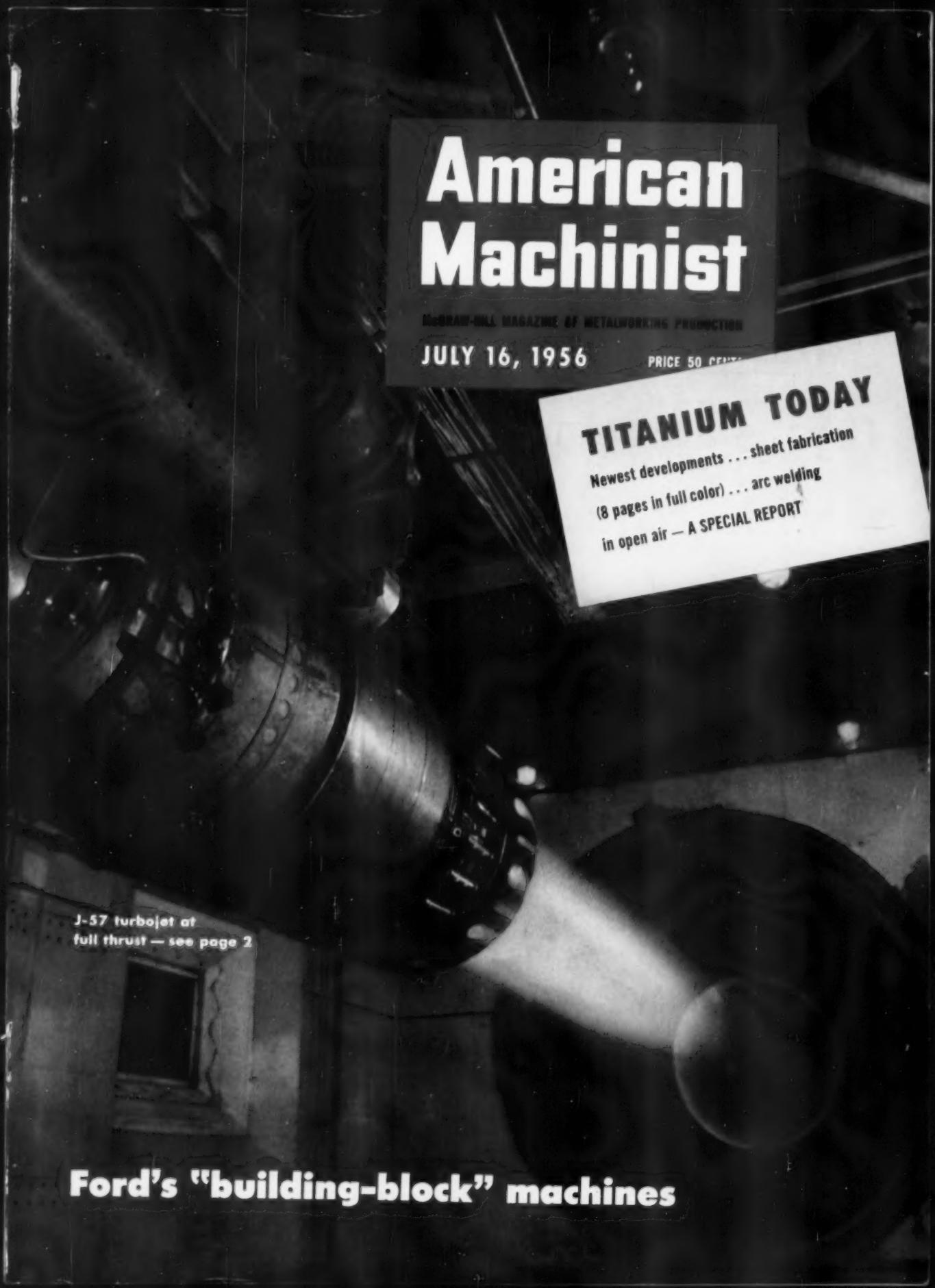


American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

JULY 16, 1956 PRICE 50 CENTS

TITANIUM TODAY

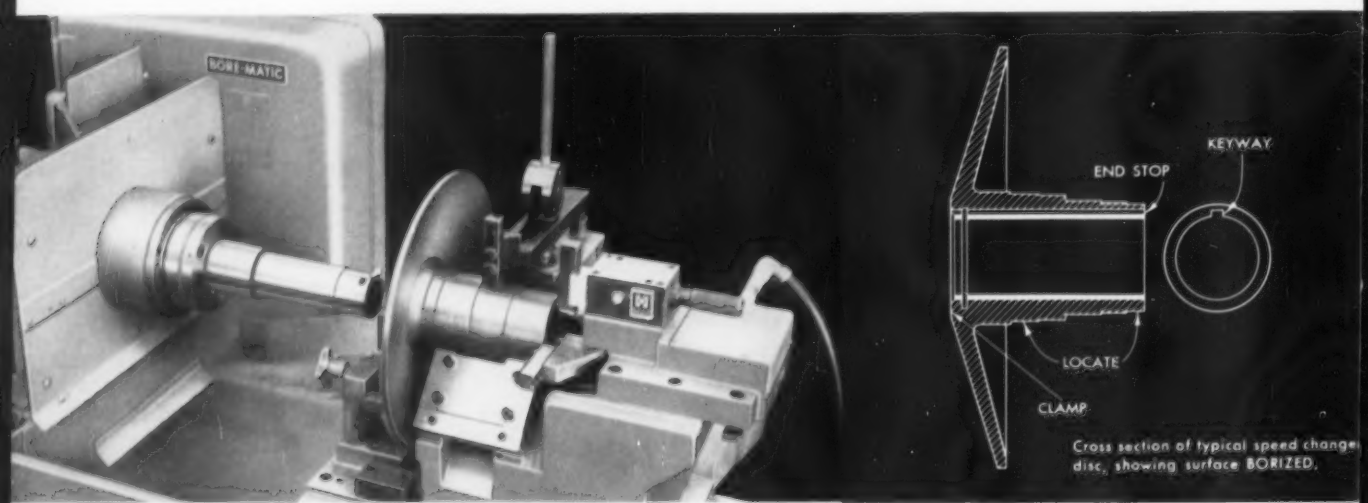
Newest developments . . . sheet fabrication
(8 pages in full color) . . . arc welding
in open air — A SPECIAL REPORT

J-57 turbojet at full thrust — see page 2

Ford's "building-block" machines

The extreme versatility of Heald **BORIZING*** permits faster precision finishing of both long-run jobs and small-lot work with frequent changeovers

FOR EXAMPLE: *This One Bore-Matic Finishes 41 Different Parts, with a production increase of over 200%!*



Cross section of typical speed changer disc, showing surface BORIZED.

The Model 221 Bore-Matic shown above is equipped with interchangeable tooling and adjustable fixture for precision boring 41 different speed changer discs, with bore diameters ranging from 0.688" to 3.2510" and bore lengths from 2⅜" to 9⅜". Compared to the previous method of doing the same job, BORIZING increased total net production from 4 parts to 13 parts per hour.

It PAYS to come to Heald

**BORIZING is a copyrighted word meaning the application of any number or variety of precision finishing operations performed on a Heald Bore-Matic.*

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Carbon dioxide slashed our welding costs . . . Production testing gives comparative costs on identical jobs shielded with argon, helium, and carbon dioxide. *By R J Keller and J P Koss, A O Smith Corp* **118**

Chase left-hand threads in a non-reversing lathe . . . One way is with a turret attachment that speeds up to chase the work in more ways than one. *By Robert C Greer, Caterpillar Tractor Co* **121**

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Titanium alloys are welded in open air . . . Fusion welding is practical and economical with automatic inert-gas-shielded tungsten arc; manual welding is promising. *By Ben C Brosheer* **141**

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American Machinist *Chips*

Cover . . .
A Ford-built Pratt & Whitney J-57 turbojet operates at full thrust inside a test cell. The engine alone is rated at 10,000-lb thrust, but the afterburner, used here, increases the rating. Engine with afterburner is almost 22 ft long.

Inside problem . . . We think the cover picture is the first ever taken *inside* a test cell with a turbojet under full thrust. And from what Stan Andrews, Ford staff photographer, went through to make it, it may well be the last. A 4x5 Speed Graphic camera was rigged with a solenoid trigger for remote control. The camera was anchored in position with 500 lb of dead weight and 12 flash guns were mounted in the cell. The first attempt was a total failure. When the engine was started, seven flash bulbs were sucked into the exhaust tube. The second attempt (with screw-type holders for the bulbs) produced the picture on our cover.

Titanium Today . . . The Special Report for this issue began to grow last spring when most of the editors spent a morning passing around a 35-mm viewer and admiring a series of slides showing fabrication of the titanium shroud for the J-57 in the Convair F-102A. The work of Robert P Herrmann, staff photographer at Convair, they combined fine color values with a technical perception hard to find in a color photographer. Tangerman had seen the operations when he was in San Diego last winter and knew that it was a story that should be told. Now he wanted to tell it in color.

At about the same time, Ben Brosheer sent word from Chicago that Ford's Aircraft Engine Division (one of the J-57 builders) was now welding titanium alloys without resorting to an enclosure for the work. Another story that had to be told as soon as possible. To top it off, we knew that titanium was coming out of the doldrums, largely because of the J-57 and the new planes into which it is going.

A series of volatile staff conferences in New York, punctuated by telephone calls to and from San Diego and Chicago, put all these ideas together into a report on "Titanium Today" that would explain major developments since our last report, would be built around 29 color pictures (probably the most ever used in a single article in a business paper). Tangerman, Ashburn, and Brosheer began the research and writing. Rooman started to work on the layouts, and our production departments began the search for the right paper, engraving, and printing techniques for a project of this scope. This is written before we see the final result, but starting on page 129 you can judge whether the reality is as exciting as the concept.

Coming . . . *AM* for July 30 will feature a Special Report on machine capability studies at York Corp. We'll have a summary on Russian work in electrical discharge machining, several articles giving tooling ideas, plus our regular departments. By the way, how do you like the change in our Contents and Chips pages?

Leon E Laux . . . author of the article on tumbling, is supervisor of Manufacturing Research and Development for Glenn L Martin. Born in Michigan, Mr Laux studied at the University of Wisconsin, the American Institute of Management, and the University of Maryland. After three years with Cutler-Hammer and eleven with Globe-Union, he joined Martin as a tool designer in 1940, advanced in stages to his present post which he reached in 1951. He is a past chairman of the Baltimore chapter of ASTE.

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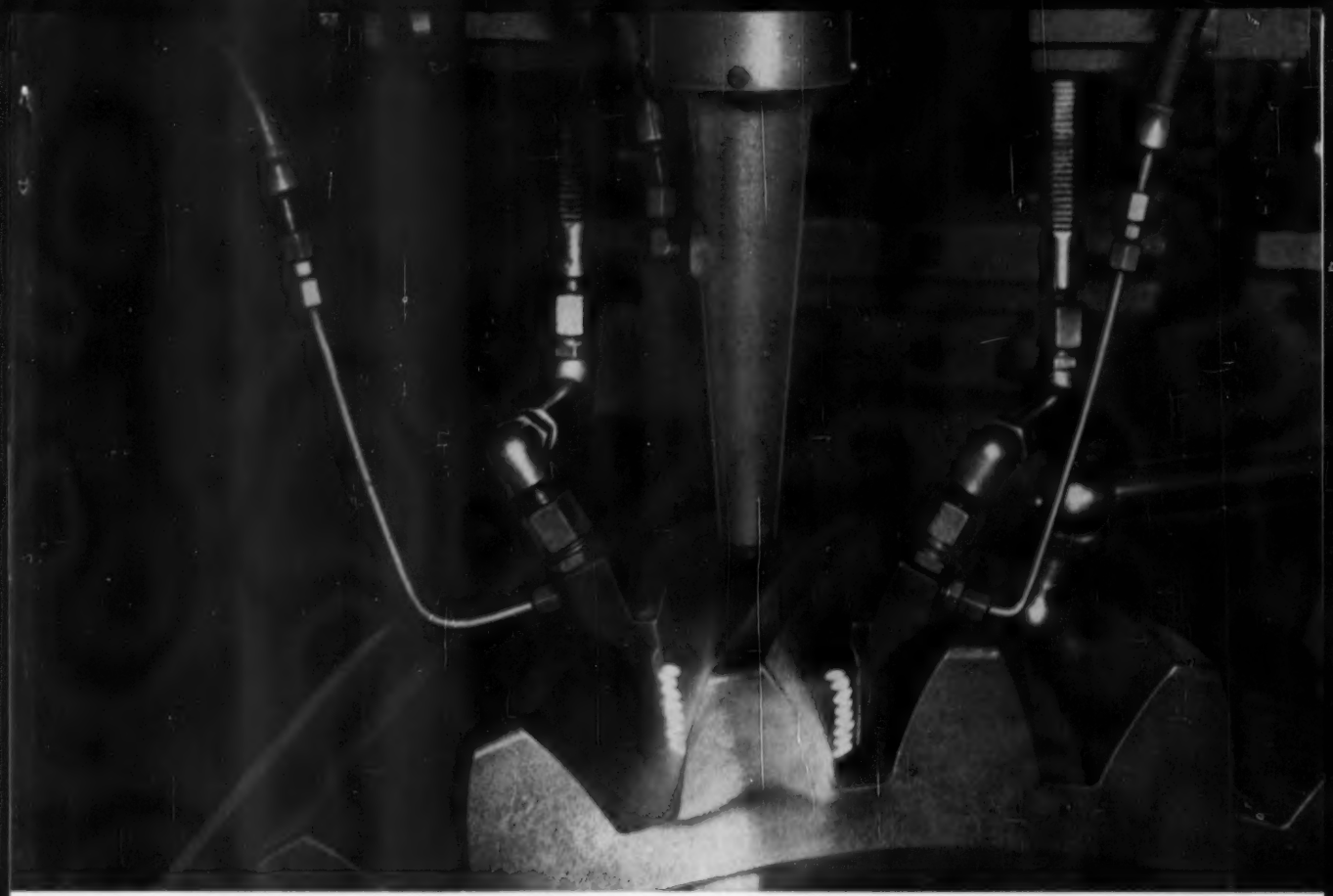

It uniformly controls
surface hardening of gear teeth

You can step up the wear resistance of gear teeth greatly with Gleason Surface Hardeners. They provide localized hardening *without distortion* because of uniform temperature control.

Key to this performance is the radiation pyrometer and electronic controls. That vertical gun-like barrel in the center of the photo above is the radiation pyrometer. It is focusing directly on the tooth being hardened. As the oxyacetylene burners heat the tooth, the thermopile receives radiant energy from the heated metal. An electronic balancing device converts that energy to control forces which govern the travel of the burners along the tooth.

This makes surface hardening of gear teeth an exact operation. There is no measurable distortion because only the gear teeth are heated and each tooth is heated uniformly on both sides. The region of hardness is limited to the wearing surfaces, thus greatly increasing gear life.

Gleason Surface Hardeners assure absolute uniformity of all teeth on a gear and every gear in a lot. They are adaptable to hardening straight bevel, spiral bevel, Zerol, spur, herringbone and helical gears. For additional information, write for the booklet "The Surface Hardening of Gear Teeth."

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FILMATIC
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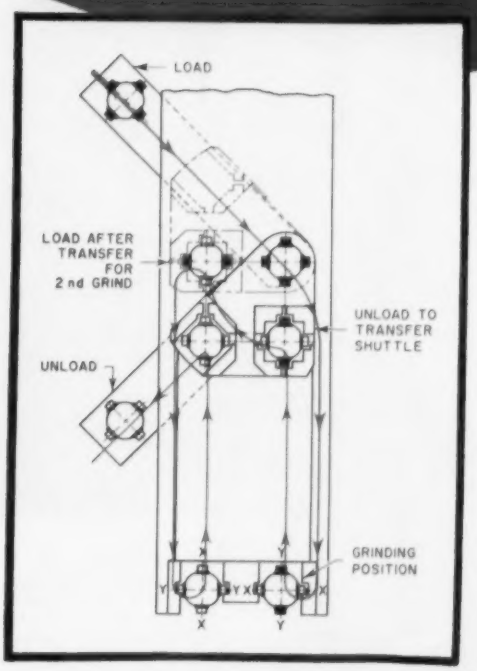
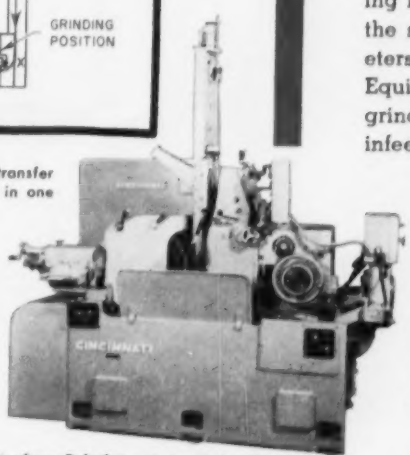
Unique Transfer Idea Solved This Problem:

To Automatically Grind Four Diameters of Universal Joint Spiders in One Cycle



Schematic drawing of loading and transfer fixture. Parts are ground on axis X in one station, and axis Y in the other.



Two universal joint spiders are in process at the same time, grinding two pin diameters on each of two parts. Estimated production, 300 completed parts per hour.

Everyone familiar with universal joint spiders will agree that it's a neat trick to automatically grind the two pin diameters on each of two parts at the same time. Cincinnati automation specialists devised a way to do the job on a new CINCINNATI® FILMATIC No. 2 Centerless Grinder. A unique transfer mechanism, incorporated in the loading fixture developed by Cincinnati for the machine, was the key to this low-cost method of production. Principle of operation is diagramed at the left. ¶ There are four grinding and four regulating wheels. To advance from one grinding station and set of wheels to the next, the transfer mechanism, during the retraction segment of the grinding cycle, simply takes the part from the first station, swings it 90°, orienting it and depositing it on the loading fingers for the second operation. In this manner, four diameters and adjacent radii are ground each cycle. Equipment includes automatic profile truing for the grinding wheel and electro-hydraulic automatic infeed attachment. ¶ The manufacture of universal joint spiders may not be your line of work, but some type of precision cylindrical grinding is required in your shop, and Cincinnati grinding and automation specialists can help you do a better job at lower cost. You can be sure that these men will give you the benefit of the most advanced thinking in centerless grinding methods, backed up by 33 years' experience. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped to automatically grind universal joint spiders. You will find brief information on the standard No. 2 machine in Sweet's Machine Tool File. For complete data, write for catalog No. G-644-1.

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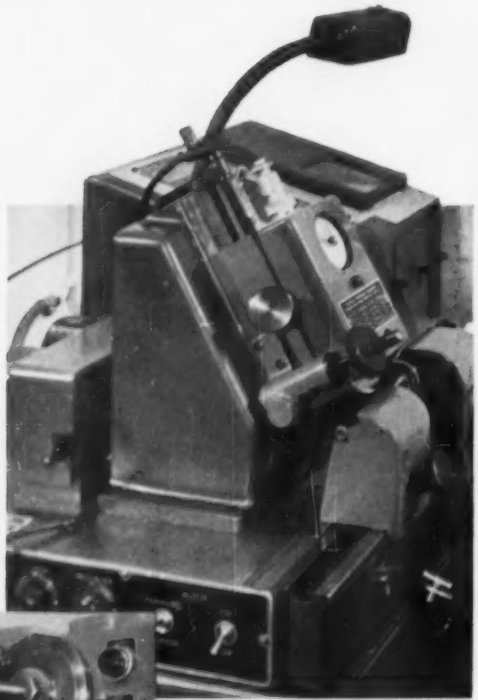
2. Extra precision: Fellows No. 4 Fine-Pitch Gear Shaving Machine makes good gears better with finer finish, minimum backlash, tighter tolerances where desired.



3. Proof: Fellows No. 4 Fine-Pitch Red Liner Inspection Instrument makes a permanent, graphic record of gear quality . . . quick, efficient and accurate.

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GEARS

cuts production time up to 50%

at *ALLING-LANDER!*

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Fellows Precision Line also includes other types of gear inspection instruments and a number of models of Gear Shapers for cutting spur and helical gears of larger sizes. Your Fellows representative can give you information about any of them. And, ask him about the Fellows Plan for deferred payment too. Write, wire or phone any of our offices.

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Fellows *Gear Production Equipment*

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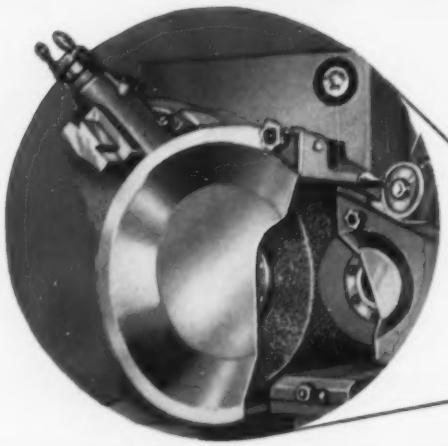
New



The new Van Norman No. 2C Grinder is *engineered* for fast, accurate, economical grinding of parts. Incorporated in the many outstanding features is the *15 HP* main drive motor which provides ample power for every grinding job. Couple this with the totally enclosed rugged grinding wheel spindle and you get close-tolerance smooth finishes plus chatterless, trouble-free operation.

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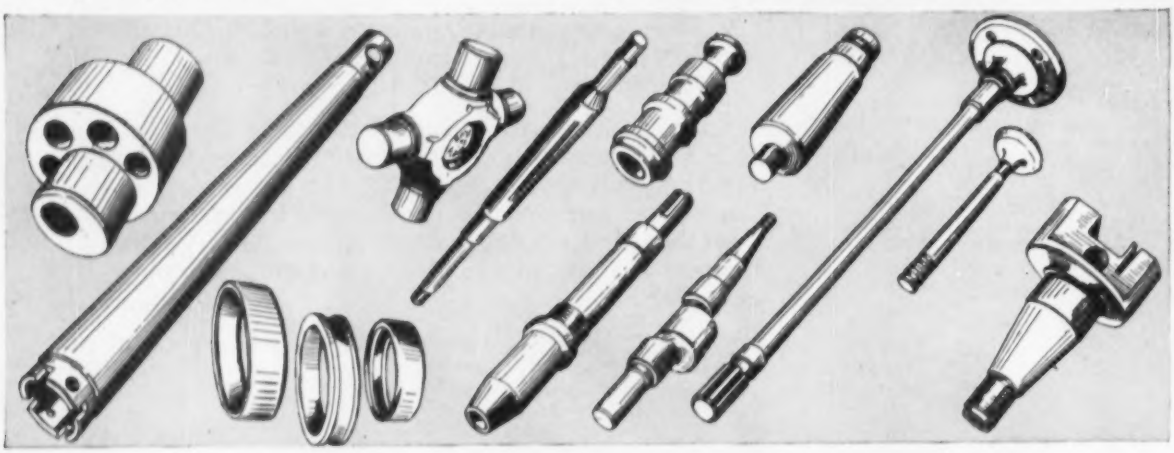
- Spindles require no warm-up period, eliminating "creep" which has always been a problem in grinding operations.
- Infinitely variable regulating wheel drive.
- Totally enclosed fan cooled, dynamically balanced 15 HP main drive.
- Independent hydraulic wheel truing devices for each wheel.
- Fine hand wheel adjustment on diameter of work piece.

Phone, wire or write for full details on the new Van Norman No. 2C Centerless Grinder.



Grind Parts Like These Accurately, More Economically

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No. 2C Centerless Grinder

...Features 15 HP Main Drive

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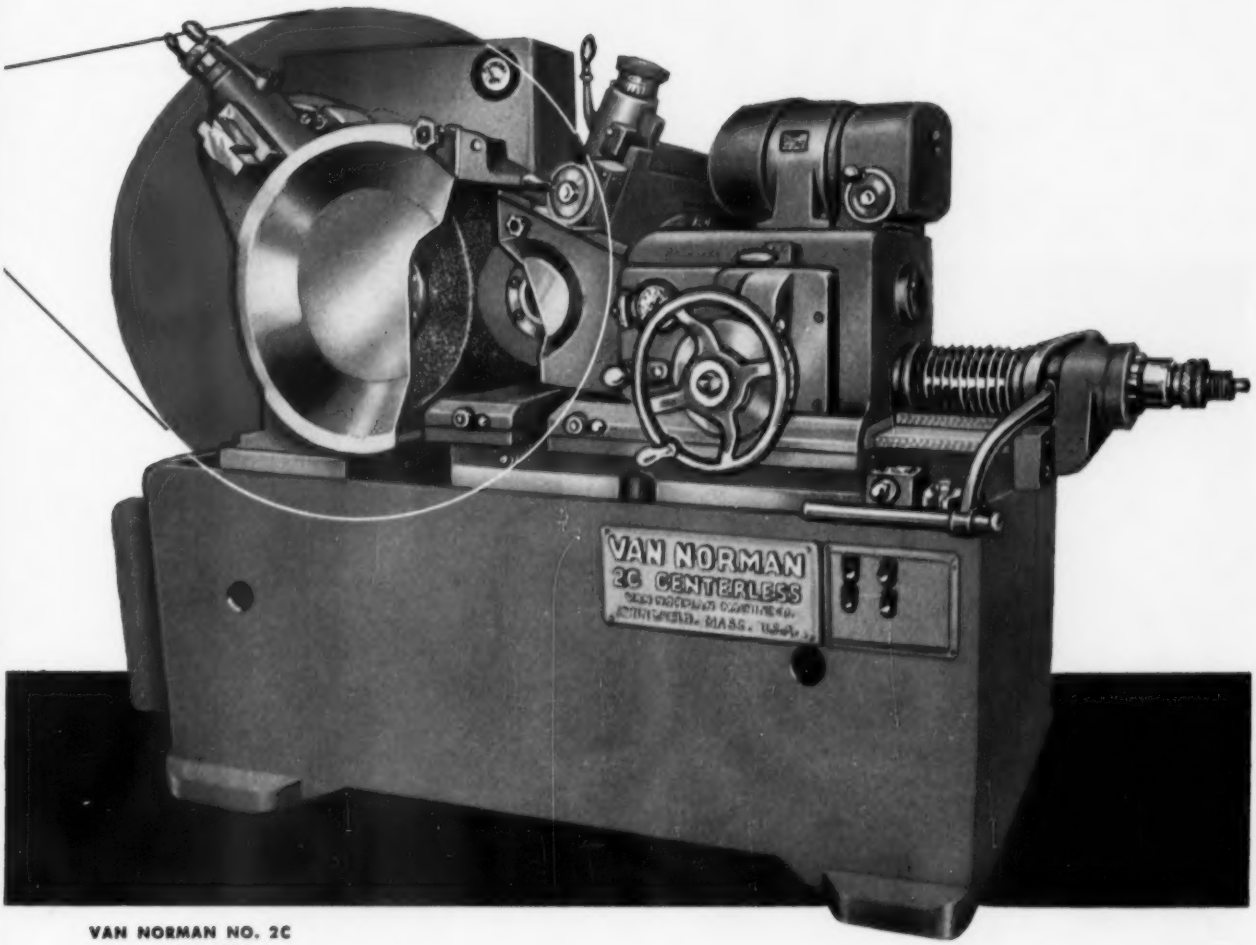

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Capacity: 0" to 4¾"
Grinding wheels available: 24" x 4" x 12"; 24 x 6" x 12"; 24" x 8" 12"
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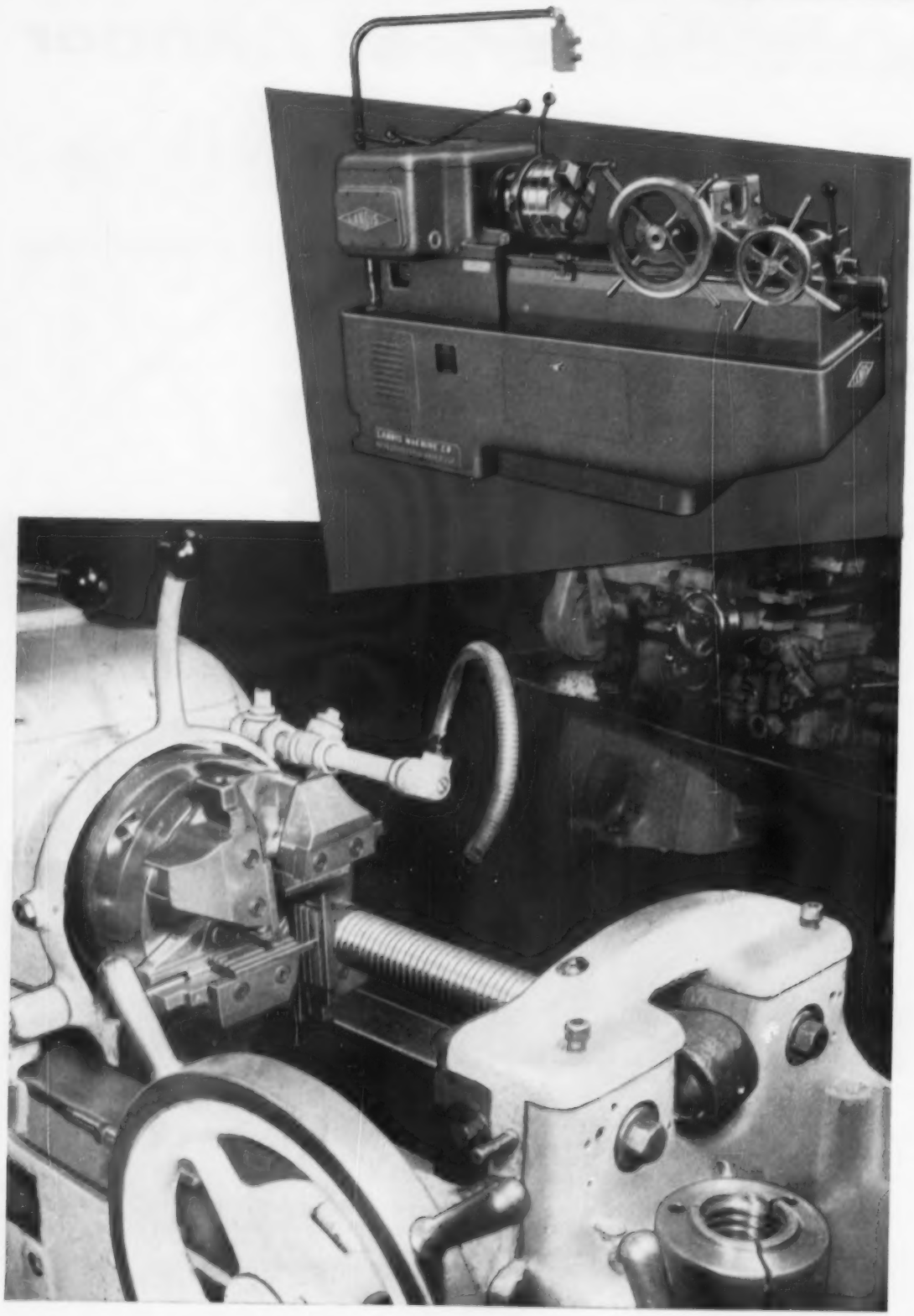

461-C

coarse threads

cut in one pass with LANDMACO machines

The cutting of large diameter Acme threads at the Iowa Manufacturing Co. of Cedar Rapids, Iowa, illustrates the heavy duty threading possible on LANDMACO Threading Machines.

1045 steel forgings of 20-29 Rockwell C are used in the production of adjusting screws for construction equipment. 2¼"-3 pitch Special Acme threads (EXTRA DEEP) are cut 10" long, with a .026 pitch diameter tolerance and a .001 per inch allowable lead error.

Cutting at a speed of 7.6 surface feet per minute, 12.5 pieces are completed per hour. This includes 100% gaging on the machine, using go-and-no-go gages. Despite the large amount of metal removal, at least 80 pieces are produced between chaser grinds.

This job is an excellent example how such heavy-duty threading can be done with the LANDMACO Machine. The 2½" Single Spindle Machine (½" to 2½" range) used here features heavy construction, hardened-and-ground ways, lead screw attachment, and is equipped with a rugged LANDMACO Tangential Chaser Die Head. Roughing-and-Finishing Centering Throat Chasers produce heavy cuts in one pass of excellent finish, eliminate the out-of-roundness common in long heavy workpieces, and provide low tool cost.

LANDMACO Machines offer precision and heavy duty threading within a range of #4 to 4" in diameter. For more detailed information, please send specifications when writing.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

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One Machine for all these grinding jobs

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Landis 12" x 28" Universal and Tool Grinder —two machines in one—a tool grinder and a universal grinder. Catalog K - 53

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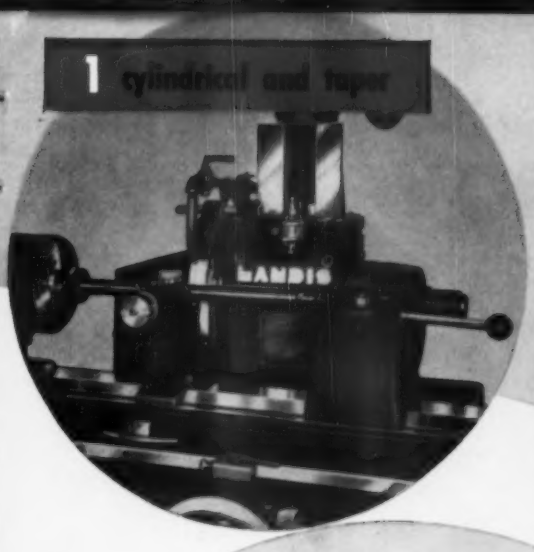
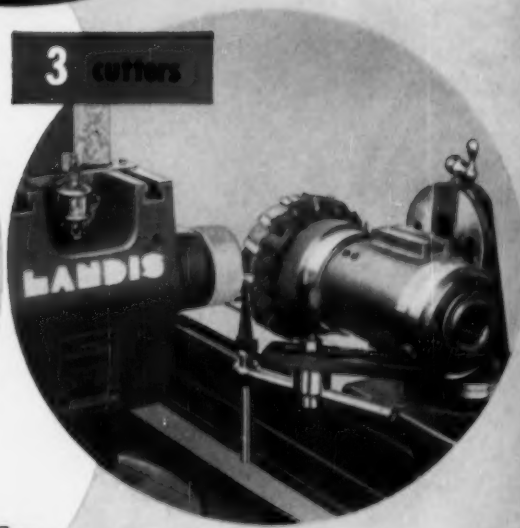
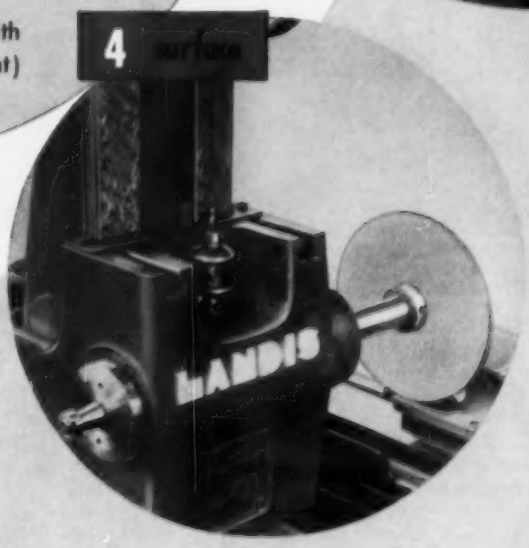


Also sharpens these tools:

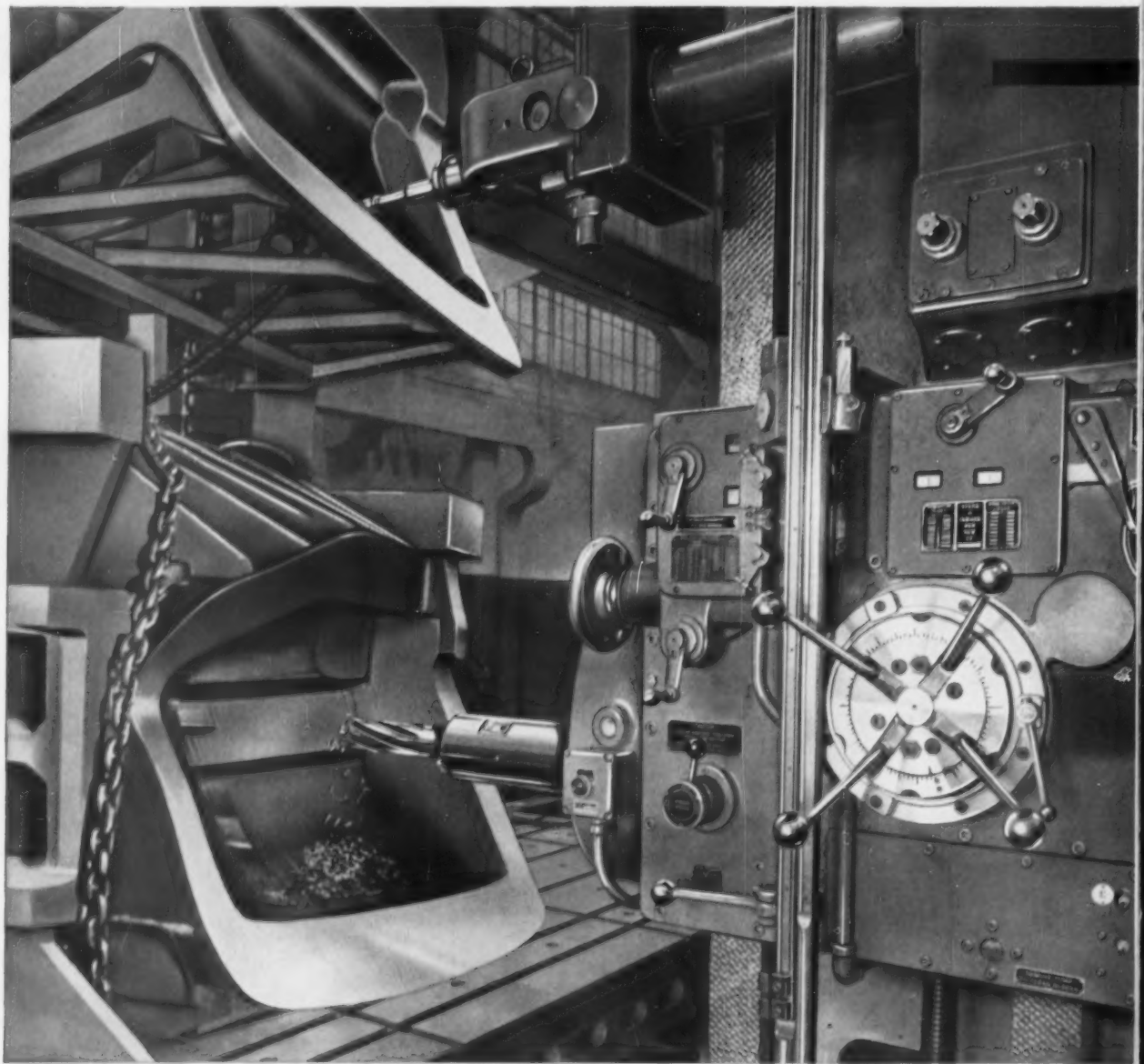
- Taps
- Formed cutters
- Spiral mills
- Milling cutters
- Hobs
- Forming tools
- Gear cutters
- Face mills
- End mills
- Drills
- Saws
- Reamers

(All operations can be done with standard and extra equipment)





Available now...the



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With the *Dupli-Tracer* Giddings & Lewis Horizontals can do work on forms and intricate contours at extremely high feeds and speeds.

TRACING SYSTEM — The 3-D unit operates on a selective dual system, providing simultaneous control of the saddle and headstock or saddle and table for contour milling, or alternatively, table and headstock may be automatically controlled to give 360° profiling.

A single tracer head, mounted above the headstock, is extremely sensitive to deflections in all three axes used for tracing work. The three feed motions are driven by separate d-c motor-generator units. Generators are regulated by an electronic control which receives its signals from the tracing head. Feed rate in low gear can be varied from .4 to 5 inches and in high gear from 4 to 40 inches per minute.

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Giddings & Lewis offers machine tool users the most advanced 3-dimensional electric stepless tracing and duplicating unit ever devised for contour tracing and 360° profiling operations

NOW you can obtain Giddings & Lewis Horizontal Boring, Drilling and Milling machines (table, floor and planer types) or Vertical Boring Mills with the most versatile 2- or 3-dimensional electric tracer unit ever offered.

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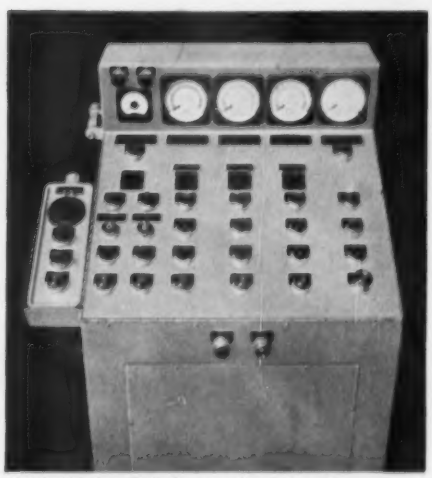
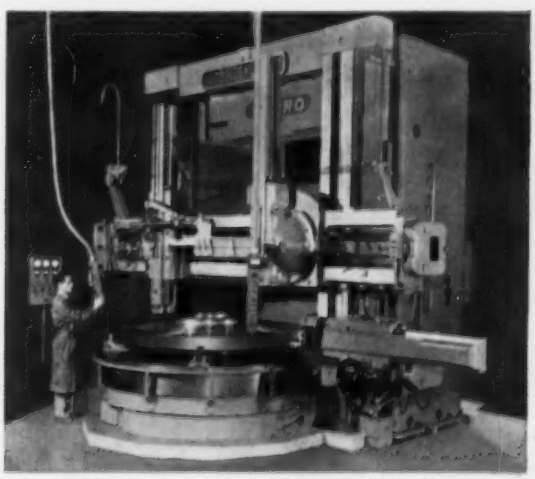
For more information on Horizontal and Vertical boring machines, equipped with the new *Dupli-Tracer*, see your nearest G&L representative, or write to Giddings & Lewis Machine Tool Co., Fond du Lac, Wisconsin.



All indicating dials for speeds and feeds, movement of table, saddle and headstock, tracer steering and contouring plus controls for conventional operation of machine are conveniently grouped for quick and easy selection.

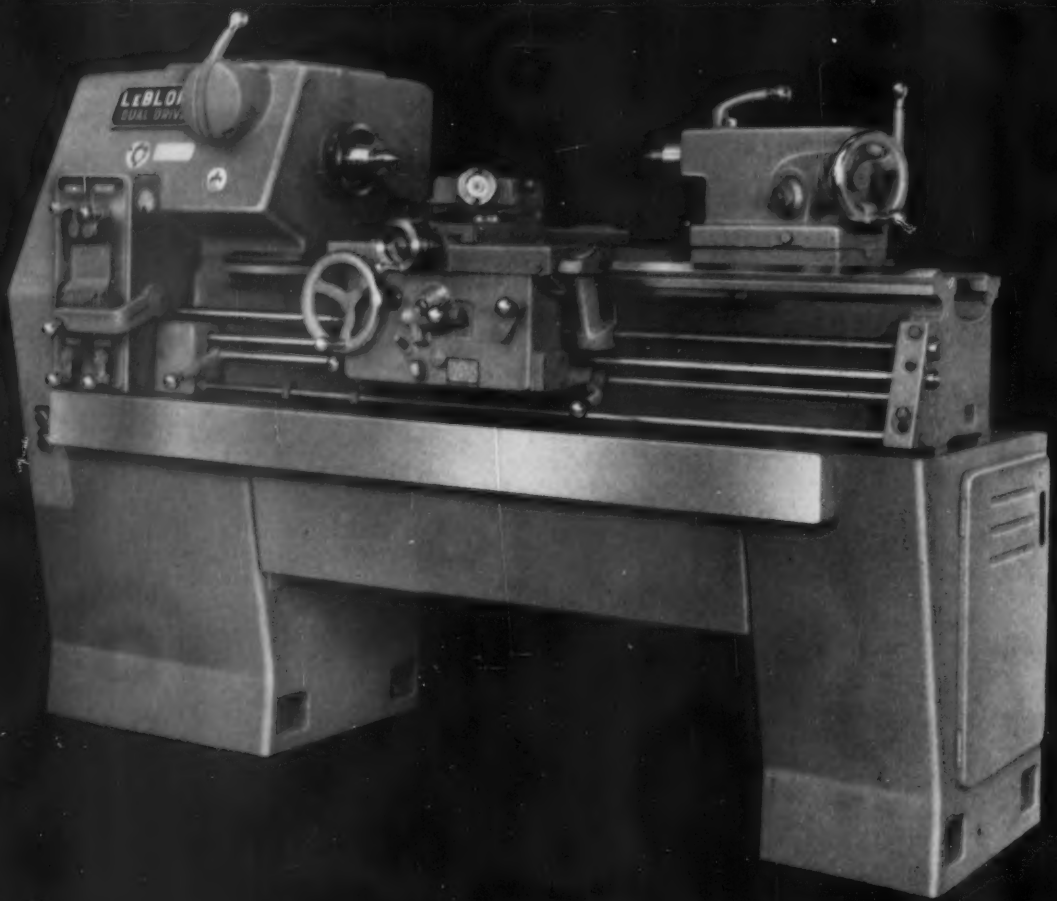


When Giddings & Lewis Vertical Boring and Turning mills are equipped with the new *Dupli-Tracer*, they provide 2-dimensional tracing. The ram and saddle motions of the left-hand head are controlled by the 2-D unit. Each motion has a d-c motor, plus amplidyne-generator feed drive.

GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Boring and Cutting Tools. 6-55

a LeBlond Dual Drive costs



gives you more than higher priced lathes

Totally-enclosed quick change box is automatically lubricated, provides 48 feed and thread changes.

Rugged apron and carriage gives long-lived precision. Shown with compound and plain connected rest.

Hydra-Trace® makes the Dual Drive the least expensive tracing engine lathe of comparable quality.

only $4625*

More useful power, more swing capacity— plus all the precision, convenience and long life that LeBlond knows best how to put into a lathe! Briefly, this is why the Dual Drive is considered the best buy for medium duty turning by companies who want the most productive capacity per dollar invested.

Virtually all of the 5 hp is available for cutting due to headstock design which uses both gear and non-slip belt ranges. Sixteen speeds from 31 to 2400 rpm are chosen by a single lever.

Swing over bed and carriage wings is 15", over compound, 9½". A single lever controls both cross and length feed. Quick change box is totally-enclosed, provides 48 feed and thread changes. Tailstock is of the thrust-lock design. Hardened and ground steel ways are arranged according to the compensating principle which distributes cutting forces for maximum life and precision.

For specialized turning, a variety of attachments are available. The addition of Hydra-Trace,* for example, makes Dual Drive the least expensive tracing lathe you can buy of comparable capacity and quality.

Whatever your turning needs, there's a lathe in LeBlond's complete line to do the job. 76 different models to choose from. Call your LeBlond Distributor or write for complete information about the Dual Drive, Bulletin 6A.

*Hydra-Trace (Trade Mark registered U. S. Pat. Off.) is LeBlond's heavy-duty hydraulic tracing attachment. Can be mounted in place of compound rest on practically all LeBlond lathes built since 1935.

* Base price, 30" center distance with standard equipment, not including motor or control.

. . . .

Single lever selects sixteen speeds from 31 to 2400 rpm in both gear and non-slip belt ranges.

. . . cut with confidence

LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

World's largest builder of a complete line of lathes for more than 69 years

Here's the ONE outstanding wheel... for EVERY toolroom surface grinder

The Norton G BOND-32 ALUNDUM combination is unequalled for speed, versatility and economy*

THE FAMOUS NORTON G BOND holds each abrasive grain just long enough for maximum cutting action, assuring a constant grinding surface of fresh, sharp cutting edges. With 32 ALUNDUM abrasive it makes a great "Touch of Gold" team for grinding high speed and alloy steels. For other applications investigate Norton 38 ALUNDUM or 19 ALUNDUM abrasive. And remember, only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost.

The Norton G Bond is the most efficient vitrified bond ever developed for precision and semi-precision grinding. Wheels made with it bring you these valuable advantages:

Cooler, faster cutting action . . . heavier cuts without burning . . . closer tolerances and smoother finishes . . . easier dressing and more pieces per dressing . . . more work, and more kinds of work, per wheel.

Norton 32 ALUNDUM abrasive is another big advancement in grinding progress. It grinds exceptionally cool and fast, with minimum dressing, and is ideal for surface grinding jobs requiring fast stock removal and heavy feeds.

See Your Norton Distributor

for further facts on how the G Bond and 32 ALUNDUM abrasive add the "Touch of Gold" that saves time and money and improves product quality. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1715.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

Get Top Performance From These Grinders with G BOND-32 ALUNDUM Wheels

Brown and Sharpe • Crystal Lake • Delta • Doall
Gallmeyer and Livingston • LaSalle • Norton
Reid • Sanford • Taft-Peirce and many others

NORTON

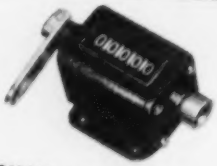
ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

Here's THE basic V-R "COUNTER-PACKAGE" for INDUSTRY...

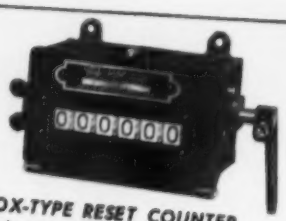


SMALL RESET COUNTER

A compact, rugged reset counter for moderate duty in parts inspection, quality control, conveyors, machine tools, light presses, etc.

Dimensions: 1¾" long, 1 15/64" high, 1⅜" wide

Speed: Up to 1000 counts per minute.



BOX-TYPE RESET COUNTER

For punch press installations, conveyors, metal-working equipment, die casting, plastic-molding, rivet, spring and wire machining, or any installation requiring a heavy duty counter.

Dimensions: 4¼" long, 2 25/32" high, 3 5/8" wide.
Speed: 500 counts per minute.

RESET MAGNETIC COUNTER

For remote indication of machine operation from plant to office.

Dimensions: 3 15/16" long, 2½" high, 1⅝" wide.

Speed: Up to 1000 counts per minute.

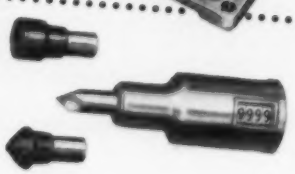
Coils: 110V-AC are standard. Other voltages are available. Panel mounting feature also available.

HAND TALLY

For quick spot-checks of production or performance.

Dimensions: 1 11/64" long (to end of reset knob), 1¾" deep, 2" high.

Counts one for each depression of the thumb lever, and resets to zero by a turn of the knob.



CLUTCH SPEED COUNTER

For checking to make sure that the machine is operating at the required R.P.M.

Dimensions: 3¼" long, ⅜" max. diameter. Non-Reset.

Internal clutch operates counter only when rubber tip is pressed against the shaft.

Here are 5 of the most widely used Veeder-Root Counters in industry . . . and they're immediately available from stock at leading Industrial Supply Distributors. There are Veeder-Root mechanical, electrical and manual counters for use in production recording and control, wage payment, time study work, quality control. In fact, you can profitably apply Veeder-Root Counters to every machine, operation, process or system in your plant. Ask your own Industrial Supply Distributor. Or write Veeder-Root Inc., Hartford 2, Conn.

Everyone can count on

VEEDER-ROOT

'The Name that Counts'

Insist on Standard

VEEDER-ROOT COUNTERS

from your

Industrial Supply Distributor

or write us on special problems

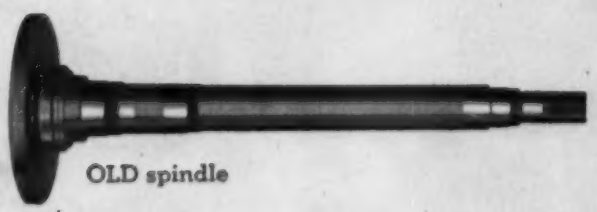
NEW 2H30 Double Spindle Grinder . . .

new spindle design improves precision—stability increased by 500%

grinds TWO parallel surfaces in ONE operation

NEW heavier spindle

500% increase in stability at rim of 30" disc



OLD spindle

Heavier spindle design in comparison with old spindle clearly shows why new 2H30 gives improved precision grinding. Note shorter spindle length combined with greater cross-sectional area that gives greater rigidity and stability. Send for your copy of the catalog describing this new Double Spindle grinder.

GARDNER

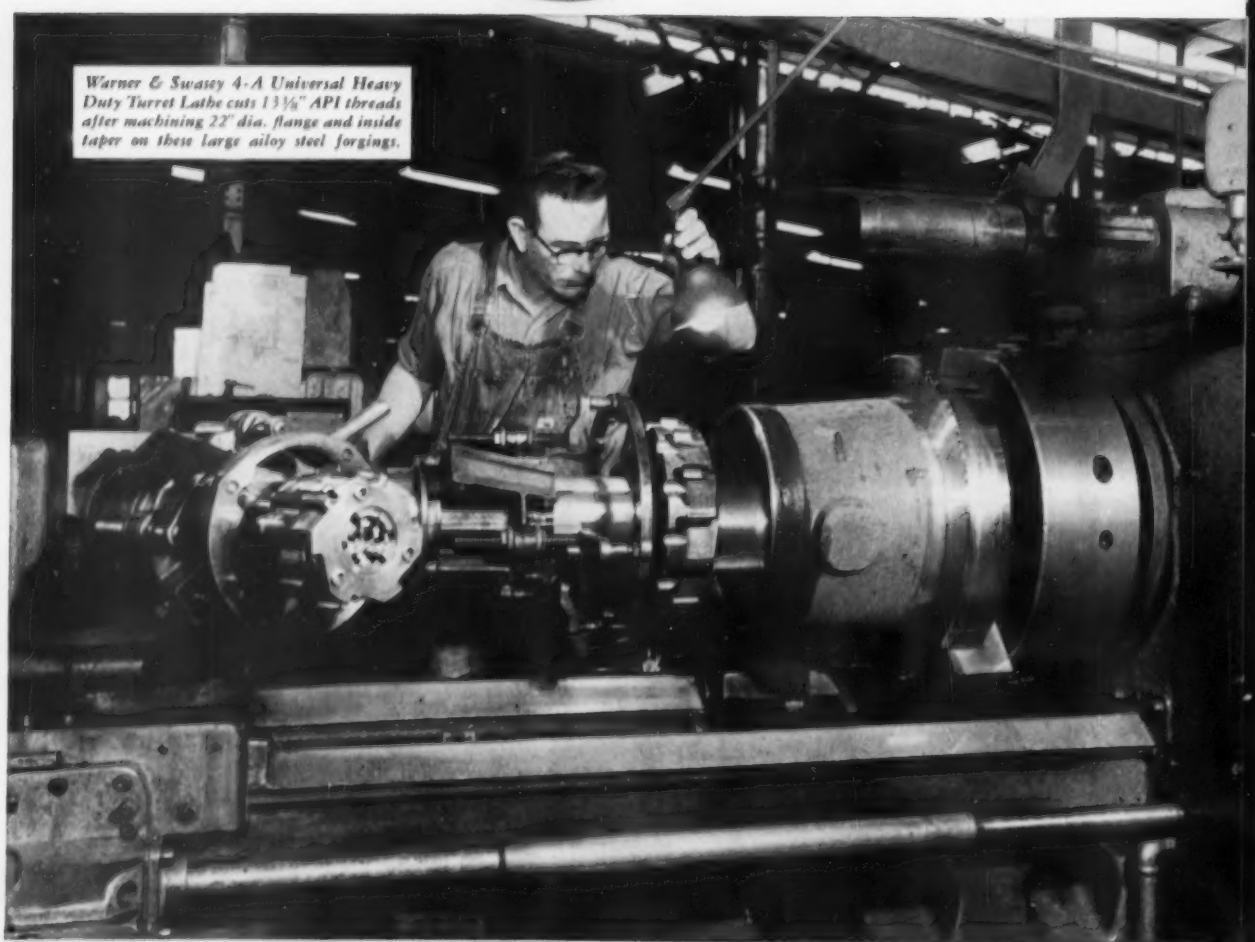
precision disc grinders

BELOIT, WISCONSIN

WARNER &

holds

at Cameron



Warner & Swasey 4-A Universal Heavy Duty Turret Lathe cuts 13⅛" API threads after machining 22" dia. flange and inside taper on these large alloy steel forgings.

SWASEY 4-A TURRET LATHE

API accuracy on 13⅜" dia. thread

Iron Works—cuts machining time 35%

In the oil fields of Texas, a pressure of 5000 psi is considered merely a working pressure. Confining such a tremendous force is routine for the oil well casing head housings produced at Cameron Iron Works, Houston, Texas.

And routine, too, is the machining of these housings and threading of the 13⅜" dia. 8 pitch API threads on a Warner & Swasey 4-A Heavy Duty Turret Lathe. That's because the 4-A has the power, rigidity, and built-in accuracy needed to meet stringent API (American Petroleum Institute) requirements, plus the ability to efficiently produce parts in lots as small as 10 to 20 pieces—and at a time savings of 35%.

Cameron's own forge shop, utilizing the most up-to-date techniques, assures control of material quality in these large housings. Eighty pounds of tough metal must be removed in the machining operations which finish up to 22" diameter x 14½" long.

The combined special and standard hexagon turret tooling provides ample tool rigidity for tough hogging cuts as well as adjustment ease for close tolerance finishing cuts. The taper bore for the API thread is single point machined with the cutter held in a special contour slide tool which follows a taper plate held in an overhead bar. This method assures maximum concentricity, size control and finish —critical elements in efficient API threading. Flexible turret tooling such as this not only permits efficient small lot production, but also allows the 4-A to handle frequent "break-ins" for rush jobs.

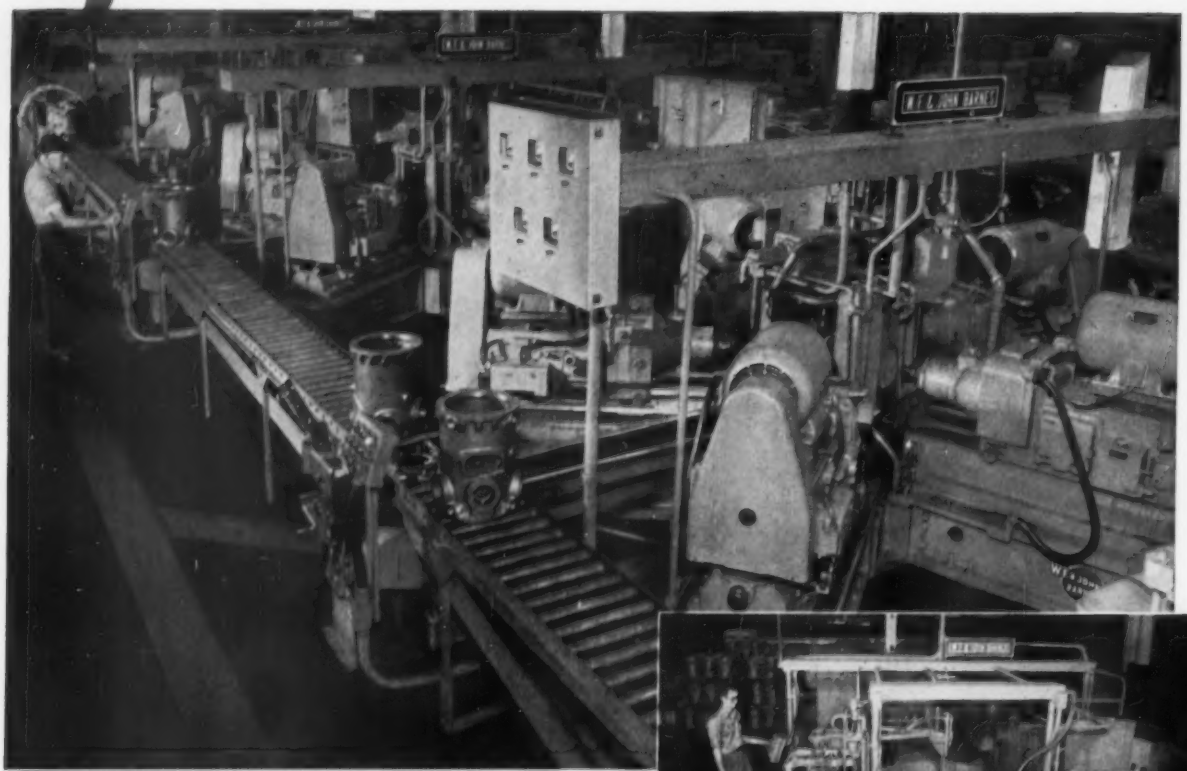
BIG JOBS LIKE THIS dramatically demonstrate the rigidity and accuracy that is built into every Warner & Swasey. The reinforced, one-piece head and bed construction, with induction-hardened (and completely protected) Vee-ways, plus the rugged design of the turrets on Warner & Swasey Saddle Type Turret Lathes, assures *retained* accuracy through years and years of tough metal cutting. When your job calls for extreme accuracy, with heavy metal removal, call in our Field Representative to discuss how you can do that job most efficiently.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

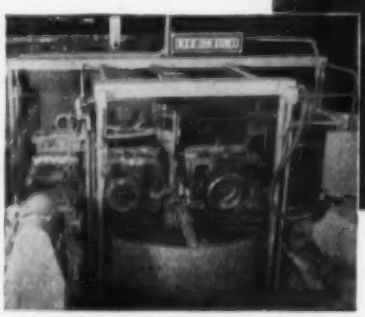
YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

HOW W. F. & JOHN BARNES

"Specials" Cut Costs on



Overall view of three 5-Way Machines. First machine in foreground, bores and faces 5 flange holes; second, performs 8 combination drilling and chamfering operations; third, handles 14 tapping operations. All three machines are equipped with power transfer from gravity conveyor. One operator loads and unloads three machines at pushbutton stations.



View showing workpieces in center turntable after 180° turn, ready for traversing into new machining position. Machining cycle at station 2 allows operator time for unloading and loading at station 1 without losing production time.

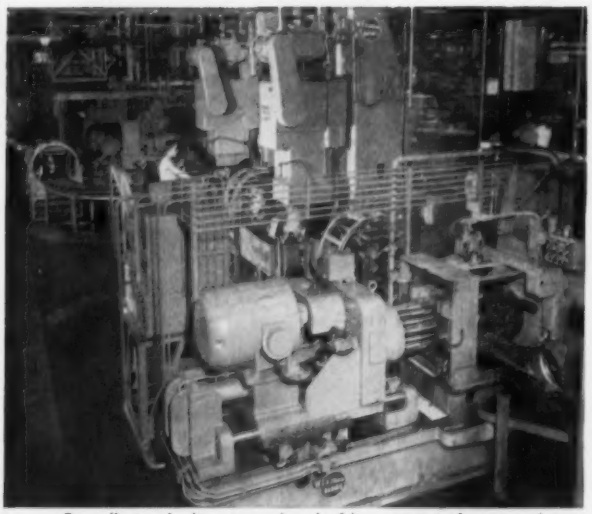
4-Way Machine with reciprocating index fixture. Left-hand two-spindle heads drill and finish-ream .750" dowel holes in both ends. Right-hand single stub-spindle heads bore, chamfer and face stator and cylinder ends.

W. F. & JOHN BARNES

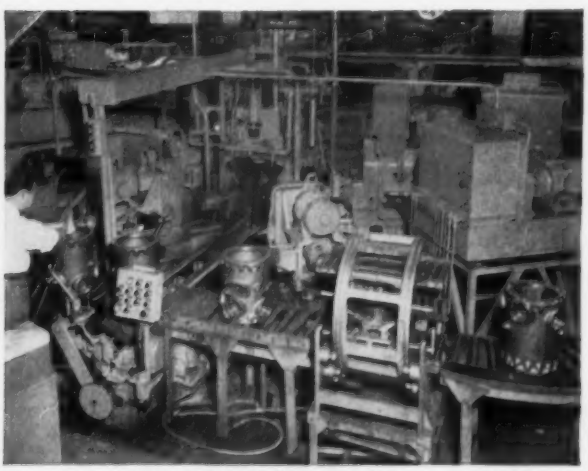
BUILDERS OF BETTER MACHINES SINCE 1872

MULTIPLE SPINDLE DRILLING · BORING · TAPPING

Low Production Work



Overall view looking toward end of line. Unit in foreground taps 31 holes in ends of piece and presses in two center bushings. Vertical machines are facing units for machining stator end and hub, and cylinder end and hub.



View of 6-Way Boring Machine for finishing five cylinder bores and two babbited bushings. Concentricity of stator and crankshaft bores is held to max. of .005" T.I.R. Babbit chips are collected in separate chip box. C.I. chips for entire line are flushed automatically to a central system.

MULTI-STATION UNITS REDUCE MACHINING TIME ON COMPRESSOR CRANKCASES 1.85 HRS. PER PIECE

At Airtemp Division, Chrysler Corporation, Dayton, Ohio, a battery of ten Barnes Multiple Spindle Machines are today demonstrating the efficiency and economy of special machines engineered to serve relatively low production requirements. Previously, the compressor crankcases used in Airtemp's fine line of large 5-cylinder commercial air conditioning units were drilled, milled, bored, faced, and tapped in single operation machines. Now, most of these operations are performed automatically in Barnes specials. As a result, machining and handling time has been reduced 1.85 Hrs. per case. In addition, close tolerances are more easily maintained which has increased product quality.

PRODUCTION GEARED TO 15 CRANKCASES PER HOUR

The Barnes Multiple-Spindle Specials are incorporated into a semi-automatic production line which is geared to produce 15 crankcases per hour. Parts are moved between machines on gravity conveyors, and operators manually position workpieces into the loading station of each machine. Powered turnover and transfer devices are included to minimize manual effort. After more than 12 months of operation, the new line has effected savings equalling the preliminary estimates of Airtemp Engineers, and at the same time has provided the additional capacity to meet an increased demand for their product with little increase in floor space.

INVESTIGATE BARNES SIX-POINT COORDINATED MACHINE BUILDING SERVICE

We suggest you investigate the profit possibility of applying Barnes special machines to your work. Find out, too, how Barnes six-point coordinated engineering and building services can help you eliminate divided responsibility and save time. Write for free brochure or ask for an analysis on any specific job.

W. F. & JOHN BARNES COMPANY

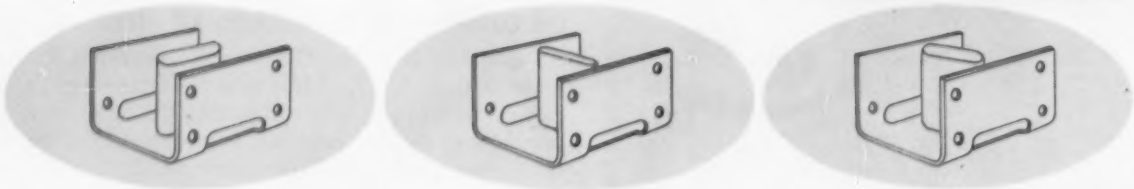
401 SOUTH WATER STREET · ROCKFORD, ILLINOIS

MACHINES · AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

here's a good example of

MULTIPLE BROACHING

. . . . on the LAPOINTE



DESIGNED TO BROACH 6 PARTS, each part different but all having 5 broached surfaces, this LAPOINTE Continuous Broaching Machine certainly makes the most of each production minute! These magnet cores must be broached to very close tolerances. Being thin, they are difficult to hold without springing and distorting — yet all surfaces must be parallel and square. That troublesome problem was solved by Lapointe-built fixtures, with automatic clamping and ejecting features.

Production, at 30 feet-per-minute broaching speed, is as follows: with 10 fixtures, 720 parts/hour; with 15 fixtures, 1080 parts/hour; with 19 fixtures, 1368 parts/hour.

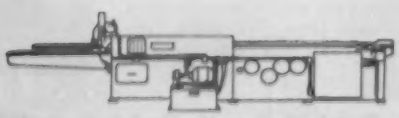
The machine is versatile. Fixtures are complete with adapter assemblies, arranged to interchangeably accept adapter assemblies for other parts. The broaches themselves are changed with a minimum of time and effort. This plant is benefiting from the conversion to LAPOINTE-BROACHING. Perhaps you can, too. Why not have a discussion with a Lapointe Field Engineer?

THE LAPOINTE MACHINE TOOL COMPANY

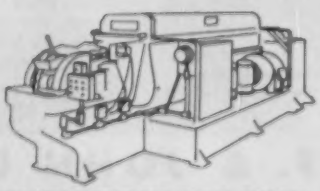
HUDSON, MASSACHUSETTS · U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

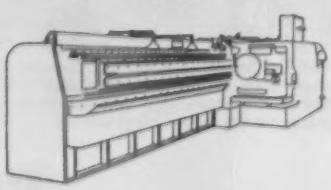
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



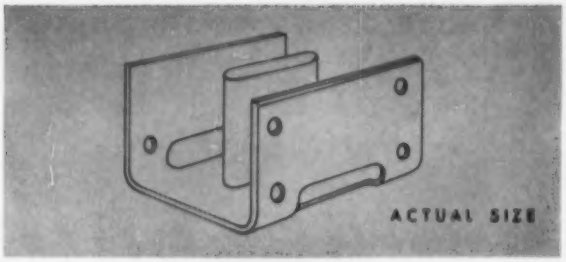
60" STROKE HORIZONTAL, ELECTRIC



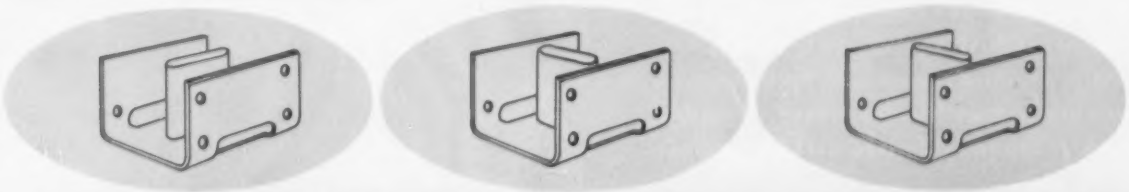
CH CONTINUOUS BROACHING, ELECTRIC

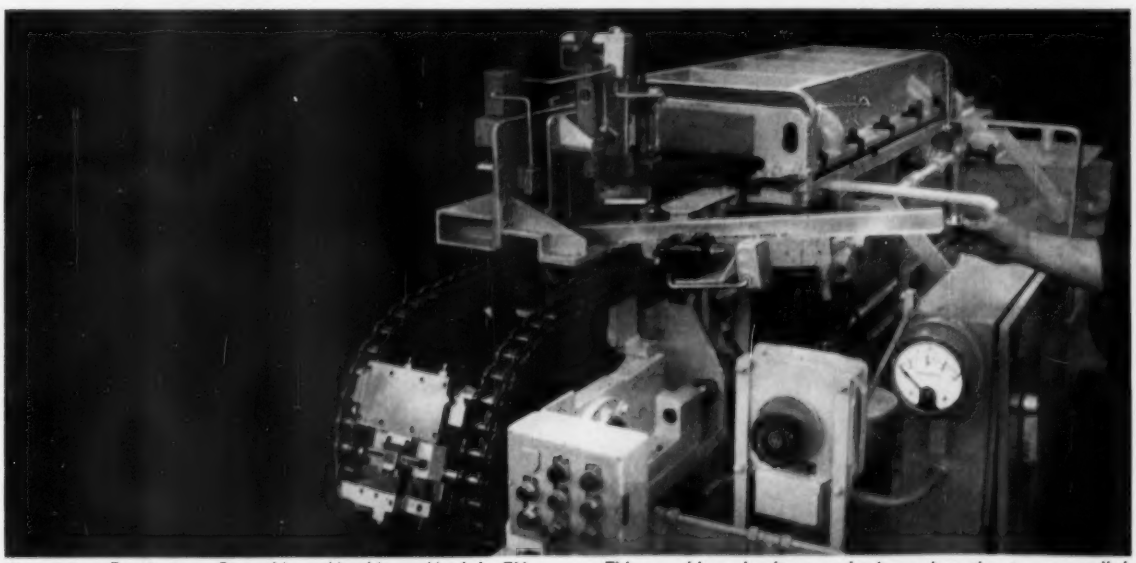


SRHE SINGLE RAM HORIZONTAL, ELECTRIC



CONTINUOUS BROACHING MACHINE

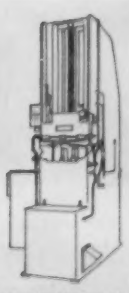




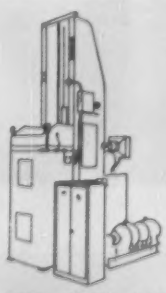
Lapointe Continuous Broaching Machine: Model CH, 10 hp., 66-inch stroke; variable speed drive, 5 to 40 feet-per-minute. Shown here with automatic loader, to broach magnet cores. Hand feed loading chute mechanically places the part in the broaching fixture, and the part will "bottom" positively in the fixture with exact yoke locating on leg edges.

This machine simultaneously broaches the two parallel top edges, the centre oval projection (.003/.005" lower than the outer edges), the 45° chamfer on one leg, and the corner break on the other leg.

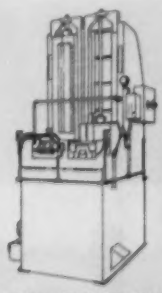
LAPOINTE takes all the responsibility for your *continuous broaching program.* We design and build the broaching machines, design and build the broaching fixtures, design and make the broaches!



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



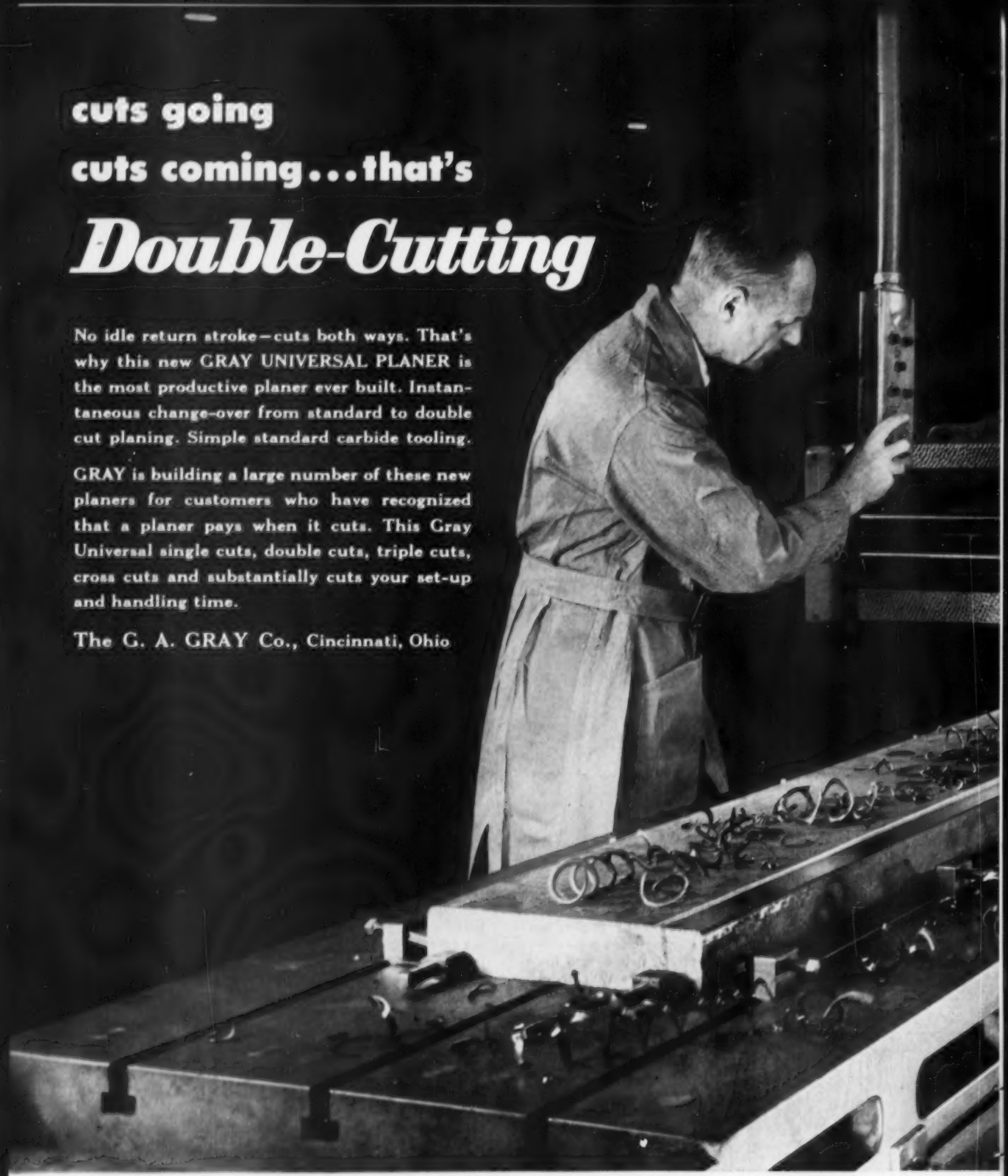
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

cuts going
cuts coming...that's
Double-Cutting



No idle return stroke—cuts both ways. That's why this new GRAY UNIVERSAL PLANER is the most productive planer ever built. Instantaneous change-over from standard to double cut planing. Simple standard carbide tooling.

GRAY is building a large number of these new planers for customers who have recognized that a planer pays when it cuts. This Gray Universal single cuts, double cuts, triple cuts, cross cuts and substantially cuts your set-up and handling time.

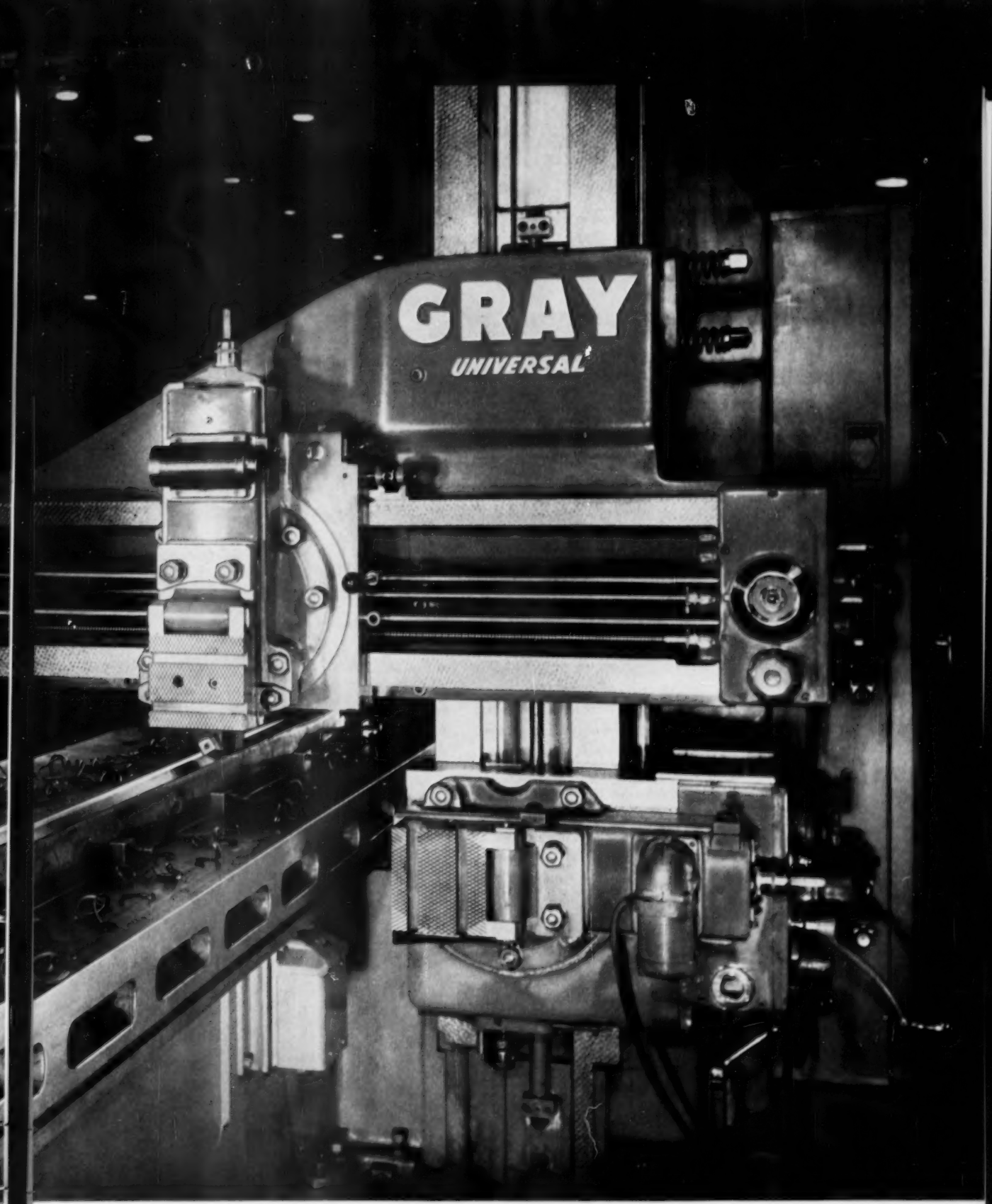
The G. A. GRAY Co., Cincinnati, Ohio

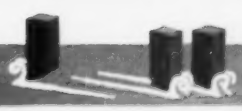
heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.

double cut planing

The flick of a lever, the touch of a button permits double cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.





triple cut planing

Rough and rough-finish plane at the same time. Rough by double cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

NEW! JOHNSON'S

New to the Johnson line of guaranteed Metal-Working Fluids, J-COOL is an all-purpose water-soluble Coolant. It offers:

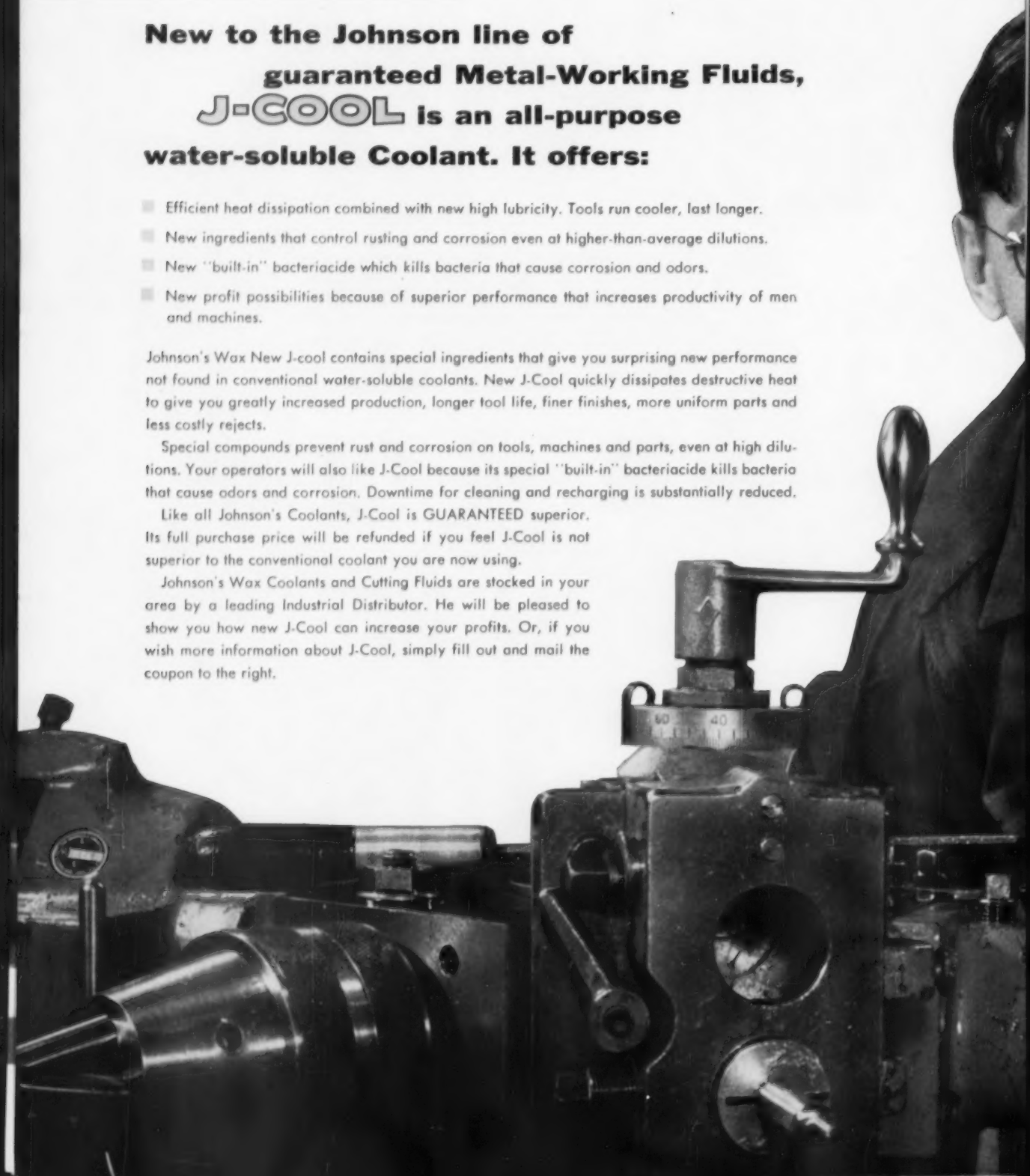
- Efficient heat dissipation combined with new high lubricity. Tools run cooler, last longer.
- New ingredients that control rusting and corrosion even at higher-than-average dilutions.
- New "built-in" bacteriacide which kills bacteria that cause corrosion and odors.
- New profit possibilities because of superior performance that increases productivity of men and machines.

Johnson's Wax New J-cool contains special ingredients that give you surprising new performance not found in conventional water-soluble coolants. New J-Cool quickly dissipates destructive heat to give you greatly increased production, longer tool life, finer finishes, more uniform parts and less costly rejects.

Special compounds prevent rust and corrosion on tools, machines and parts, even at high dilutions. Your operators will also like J-Cool because its special "built-in" bacteriacide kills bacteria that cause odors and corrosion. Downtime for cleaning and recharging is substantially reduced.

Like all Johnson's Coolants, J-Cool is GUARANTEED superior. Its full purchase price will be refunded if you feel J-Cool is not superior to the conventional coolant you are now using.

Johnson's Wax Coolants and Cutting Fluids are stocked in your area by a leading Industrial Distributor. He will be pleased to show you how new J-Cool can increase your profits. Or, if you wish more information about J-Cool, simply fill out and mail the coupon to the right.



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Guaranteed superior ...or your money back

A PRODUCT OF JOHNSON'S WAX

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Please send me additional information about J-Cool.

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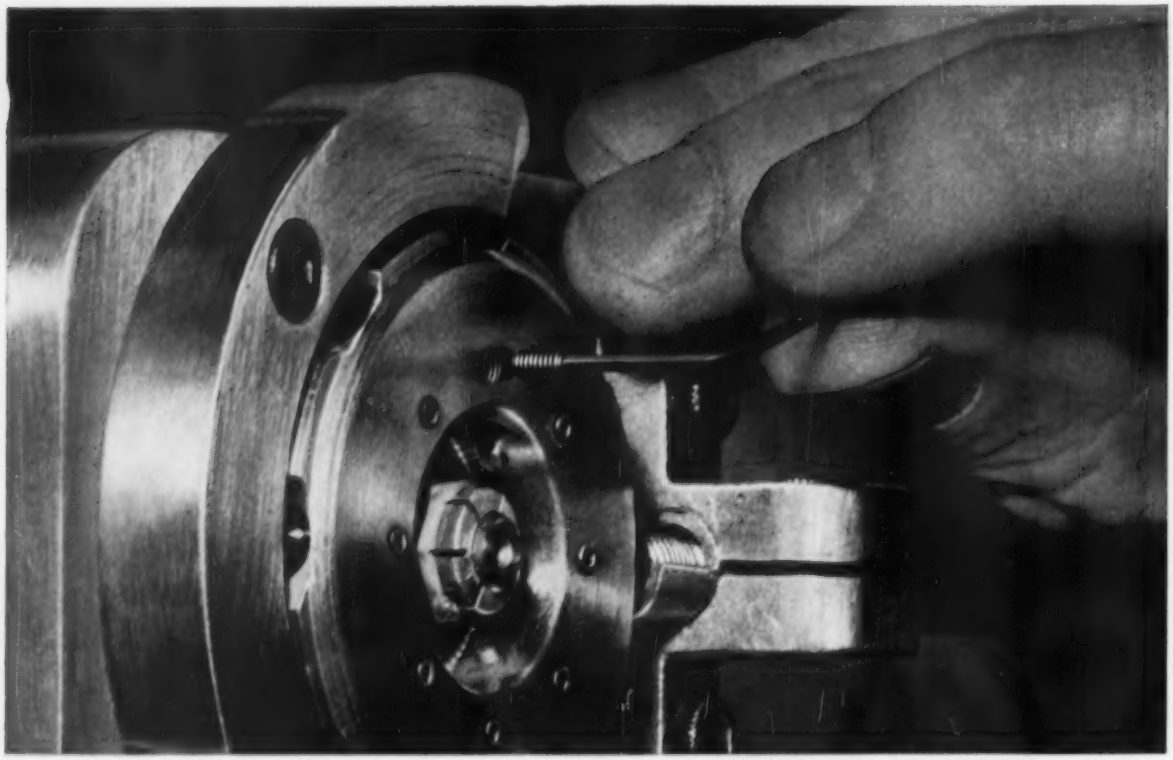


Microsize UNBRAKO socket screws simplify design problems—even in highly specialized equipment like this prototype precision loading device for use in advanced automated production operations.

Miniaturize with UNBRAKO set screws

HEAT-TREATED ALLOY STEEL*
PLAIN CUP POINT
Class 3 Fit Standard

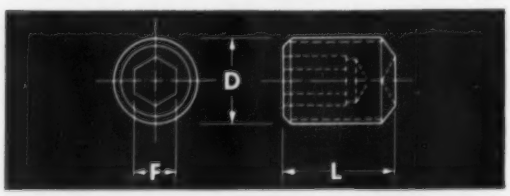
Diameter		Threads per inch NC	Threads per inch NF	L Overall Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per Box of 100 in Pounds
#0	D .060 F .028	..	80	1/16	..	.5	.01
		..	80	5/32	..	.5	.01
		..	80	1/8	..	.5	.01
		..	80	5/32	..	.5	.01
		..	80	1/16	..	.5	.01
		..	80	1/4	..	.5	.01
#1	D .073 F .035	..	72	1/16	..	1.5	.02
		..	72	5/32	..	1.5	.02
		..	72	1/8	..	1.5	.02
		..	72	5/32	..	1.5	.02
		..	72	1/16	..	1.5	.02
		..	72	1/4	..	1.5	.02
#2	D .086 F .035	56	..	1/16	1.5	..	.03
		56	..	5/32	1.5	..	.03
		56	..	1/8	1.5	..	.03
		56	..	5/32	1.5	..	.03
		56	..	1/16	1.5	..	.03
		56	..	1/4	1.5	..	.03
#3	D .099 F .050	48	..	5/32	5.0	..	.04
		48	..	1/8	5.0	..	.04
		48	..	5/32	5.0	..	.04
		48	..	1/16	5.0	..	.04
		48	..	1/4	5.0	..	.04

*Also available in stainless steel

You need not design special set screws to secure your new miniaturized equipment. Microsize UNBRAKOS were developed specifically for use in modern small devices.

UNBRAKO screws are made of carefully selected alloy steel. They are manufactured to timepiece precision. Sockets are deep and uniform for greatest wrench engagement and longest reuse. Threads are fully formed for maximum strength and exact fit. And UNBRAKOS are heat treated to the optimum condition for high tensile strength and ductility without brittleness or decarburization.

Ask your authorized industrial distributor about microsize UNBRAKO socket screws today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.



STANDARD PRESSED STEEL CO.
UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

HOW SMART PRODUCER SOLVES TRICKY MACHINING PROBLEM

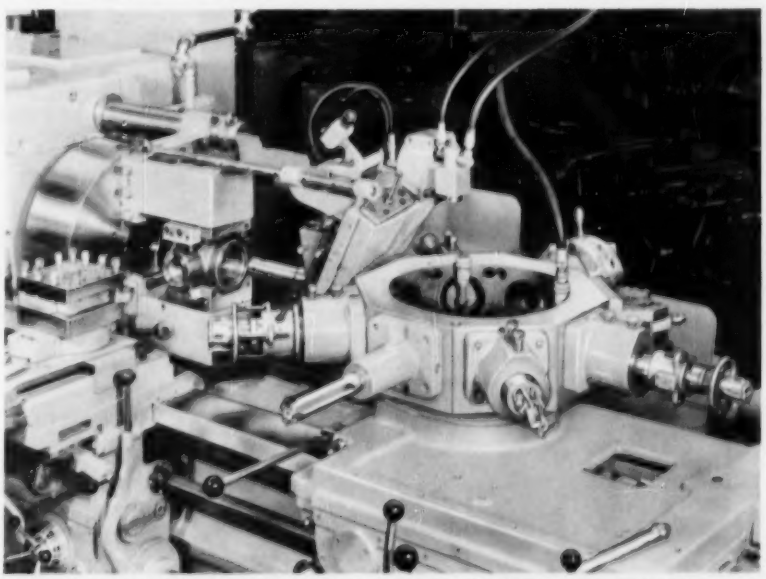
Saddle Type Turret Lathe with 4-Way Fixture and JETracer on Octagon Turret Makes Complex Job Easy

Here, the producer solved a complex problem by carefully planning his tooling and by selecting a machine designed and equipped for most efficient handling of the job.

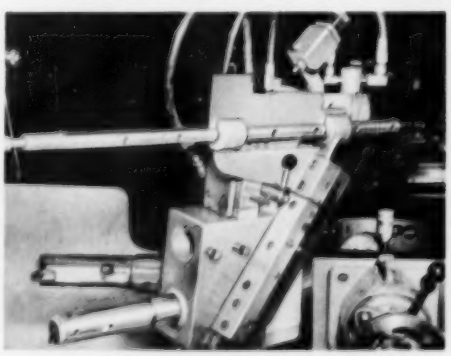
The objective was to completely machine steel valve bodies in one chucking for maximum accuracy. By using a Gisholt MASTERLINE 3L Saddle Type Turret Lathe with special features, the producer greatly simplified the entire operation.

Loading and unloading are made quick and easy with a built-in power hoist. The workpiece is held in a special four-position indexing fixture, carried in a 24-inch two-jaw air chuck. Maximum accuracy is assured by completing all surfaces in a single chucking. An eight-sided octagon turret, mounting a Gisholt JETracer on one turret face, plus seven other fully tooled turret stations and a fully tooled square turret are used to complete the job. A full-length lead screw and selective gear box are used for accurate threading. A 50 h.p. single-speed motor assures smooth, dependable operation with ample power when needed.

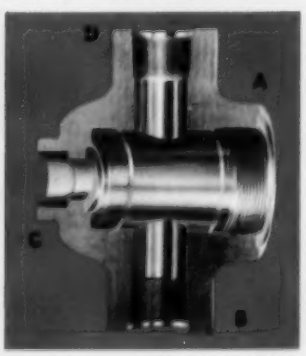
Here is the machining sequence: Locate and chuck in fixture. Machine all surfaces on End A. Index fixture. Machine all surfaces on End B. Index. Machine End C. Index. Machine End D. Index back to starting point. Contour-bore A in one pass with turret-mounted JETracer and tap to complete the part. Floor-to-floor time is approximately 25 minutes for the 2-inch screwed-end type valve body.



Close-up of tooling. Note eight-sided octagon turret, with JETracer facing workpiece.



Close-up of JETracer, which finishes all bores, counterbores, steps and faces from End A.



The workpiece—a 2-inch screwed-end type steel valve body—showing machining operations performed.

All surfaces are machined in a single chucking, using Gisholt 3L with JETracer and special indexing fixture. JETracer does not impede normal operation and offers maximum accuracy with minimum attention from the operator.

MASTERLINE GISHOLT SINCE 1887

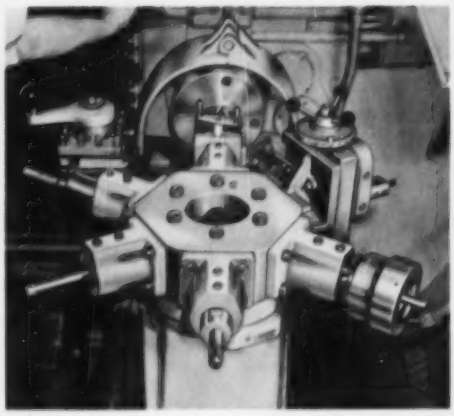
TIME-SAVING IDEAS

ACCURATE TAPER GENERATED WITH THIS SETUP

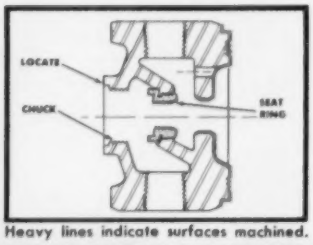
Special Boring Tool on Ram Type Turret Lathe Speeds Valve Body Output

Good headwork by this producer is saving both time and money on production of steel relief valve bodies—using a Gisholt Ram Type Universal Turret Lathe.

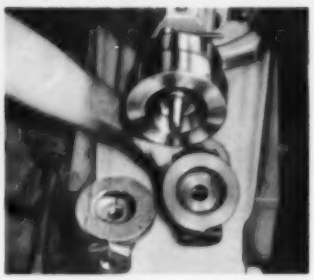
The workpieces have been previously machined and threaded in the I.D., and the seat ring has been inserted. Each part is screwed onto a special threaded fixture locating against the previously machined face. The flange and seat ring bores are machined simultaneously from the hexagon turret. Other hex turret tools ream and size both bores, finish the taper on the seat ring, and chamfer the back and front of the flange bore. Tools on the square turret turn the O.D. part way, then face, groove and form the flange face.



Overhead view of tooling, showing chamfering operation being performed in flange bore.



Heavy lines indicate surfaces machined.

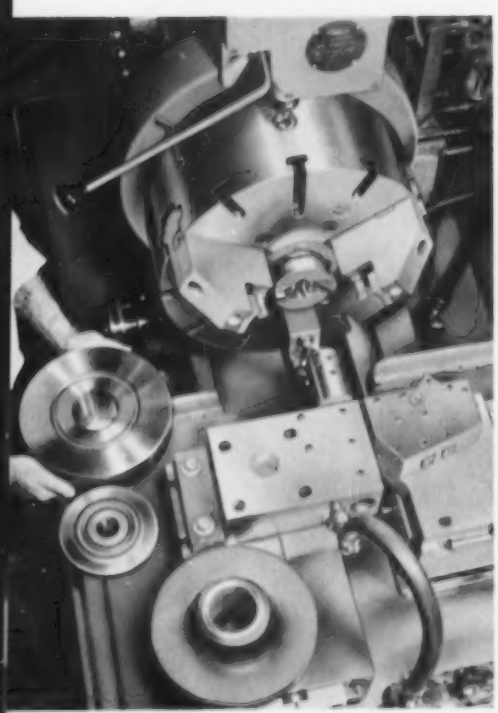


Close-up showing special taper tool, with finished workpiece below in operator's hand and rough part at left.

Of particular interest is the special taper tool, which machines the taper on the seat ring. A stop collar engages its outer face with the flange face on the workpiece, and rotates with the work. Then the boring bar—extending from the center of the tool—is cammed by continued forward movement of the turret ram, generating the precise angle desired on the seat ring.

Machining operations are simplified on this job with minimum special tooling. Floor-to-floor time is just 8.5 minutes.

BEATS HIGH COSTS ON MACHINING PARTS IN 13 SIZES



Simplimatic with Back-Facing Attachment and Two-Speed Motor Handles Each Part in Single Chucking

There's more to this job than meets the eye. Not only are two different types of parts machined, but each type comes in 13 different sizes! The workpieces—steel welding neck flanges and welding necks—are used to join high-pressure piping.

Here's how a Gisholt Simplimatic Automatic Lathe completes each part in a single chucking and holds changeover time to an absolute minimum.

Facing, grooving, boring and chamfering operations are performed from tools on short tool slides, with T-slotted tops for quick adjustment. The boring tool is relieved at the end of the cut to eliminate tool tracks. At the same time, a special back-facing attachment works through the spindle to shave-face and chamfer the O.D. on the hub. A power chuck wrench operates the scroll chuck, and permits mounting the back-facing attachment in the spindle bore. Correct surface speed in f.p.m. is provided by a two-speed motor, equipped to switch from high speed (for turning and facing) to low speed (for grooving operation) and back again, during the Simplimatic's automatic machining cycle.

Good planning on Simplimatic holds f.t.f. time on smallest 6½" diameter workpieces to only 1.7 minutes, on largest 10¾" diameter workpieces to just 3.3 minutes.

Close-up shows machined front side of large workpiece (in operator's hands) and of small workpiece...machined back side of large workpiece in foreground...power-chuck wrench...and back-facing attachment protruding through spindle bore.

WITH THE GISHOLT MASTERLINE

GISHOLT

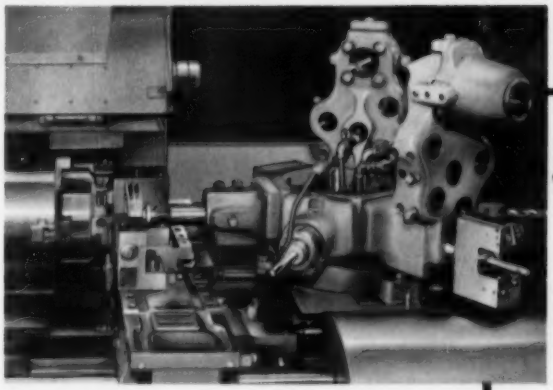
TIME-SAVING IDEAS

400% INCREASE IN PRODUCTION WITH THIS SETUP

Well-Planned Casting Design Plus Good Setup on Fastermatic Quadruples Unit Output

Here's how Albertson & Company, Inc., of Sioux City, Iowa, has put production of small, cast iron sheaves on a high-speed, high-production basis with a Gisholt 1F Fastermatic Automatic Turret Lathe. Tooling costs are held to a minimum, but where necessary, multiple cuts are taken to assure maximum accuracy.

To exploit the full potential of the versatile Fastermatic, Albertson designed the workpiece with a special chucking ring as part of the original casting. A standard three-jaw air chuck holds the part on this ring throughout the machining operations. Hexagon turret tools turn all outside diameters, complete the bore and shave-face the small hub. Special form tools on the front cross slide form grooves on small hub. Similar form tools on the rear cross slide form V-belt grooves on large sheave O.D., after which a parting tool cuts the piece off the chucking ring. Simultaneously, a special catcher on Station No. 5 slips in the bore to receive the part. The hexagon turret indexes to the next station and the cycle stops. The operator unchucks the chucking ring—inserts a new workpiece—and removes the finished sheave from the catcher, to inspect it while the new part is being machined.



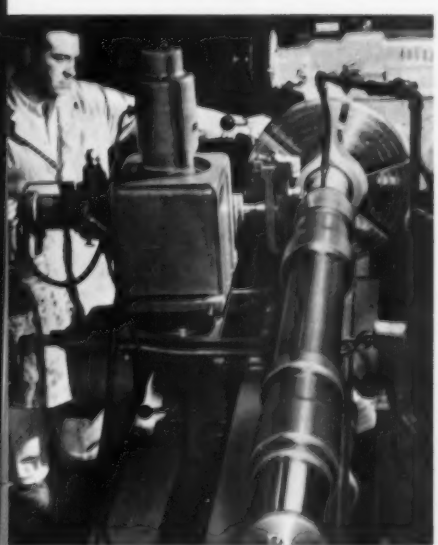
Workpiece shown after cut-off. Special turret-mounted catcher holds completed part.

Top to bottom: casting with chucking ring on; chucking ring after cut-off; finished workpiece.

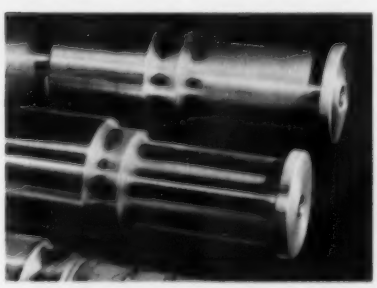
Smart setup on this Gisholt Fastermatic jumped production on this job from 24 pieces to 100 pieces per eight-hour shift—shortening floor-to-floor time to only 4.5 minutes.

"HOT BOX" TROUBLES REDUCED BY SUPERFINISH

Simple Attachment Reduces Costs, Increases Service Life



"Test" axles being Superfinished on Gisholt Saddle Type Turret Lathe equipped with No. 4 Superfinishing Attachment on the side carriage.



Before and after Superfinishing. Top journal after turning...lower journal has been Superfinished to 8-10 micro-inches rms.

The "hot box"—as applied to journal and plain bearings—is one of the most critical situations faced by the railroads today. Davenport Besler Corporation investigated the Superfinishing process and had a complete set of axles Superfinished and installed on a switcher for testing. After four months of service, no trouble was reported.

Davenport Besler then installed a Gisholt No. 4 Superfinishing Attachment on an engine lathe in its own shop. The journals are turned to an average lathe finish of 200-250 micro-inches rms. After a three-step—rough, semi-finish and finish—Superfinishing operation, a final surface finish of 8-10 micro-inches rms is obtained. The floor-to-floor time varies from 15 to 30 minutes because in some cases, .004" to .005" stock has to be removed to eliminate all toolmarks.

Over 25 switchers were put in service with all axle journals Superfinished. During the first few months, some 30,000 hours of trouble-free operation were recorded, proof-positive that Superfinish really pays off!

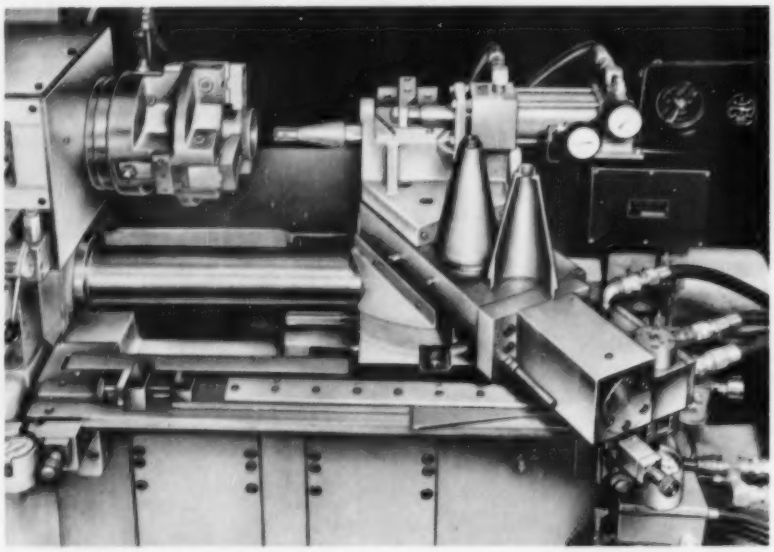
Superfinishing from a turned surface saves considerable production time. Because amorphous or smear metal is removed and the true base metal exposed, it is no longer necessary to harden the work surface—an added saving through the modern Superfinishing process.

MASTERLINE
GISHOLT SINCE 1887

TIME-SAVING IDEAS

AN EXCELLENT WAY TO HANDLE TAPER BORING OPERATIONS

No. 12 Automatic with JETracer, Variable Speed Drive and Special Fixture, Whips Problem Part



Special chucking fixture shown at left. Boring bar and tool-relief arrangement shown at right rear. Finished workpiece and cut-away section, on front of JETracer slide, show surfaces machined.

This manufacturer wanted to cut costs, increase production and improve the finish in taper boring operations on shell noses. He's doing it with a Gisholt MASTERLINE No. 12 Automatic Production Lathe, equipped with a JETracer in place of the usual front carriage.

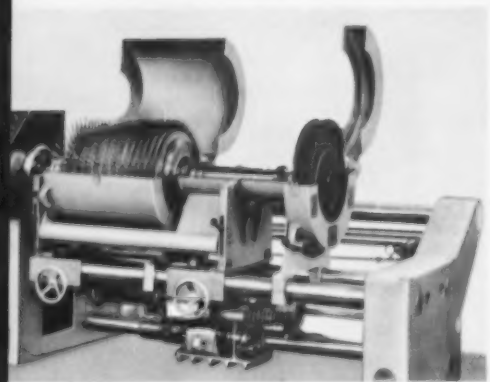
The workpiece tapers on the O.D. from four inches to 1⅛ inches. It is chucked without distortion by a special air-operated three-jaw chucking fixture, with the jaws gripping on the large O.D. Accurate longitudinal location is obtained through an adjustable work-centering cone in the spindle.

The problem of maintaining a 125 micro inch finish for the entire tapered length of cut is solved by a variable speed drive arrangement, controlled by longitudinal motion of the JETracer slide carriage. The JETracer slide traverses to the workpiece and changes to feed for the boring operation. At the end of the cut the boring bar retracts, providing tool relief, and the slide returns to starting position.

Smart chucking arrangement—plus Gisholt JETracer on No. 12—permits completing I.D. on this job in only .77 minute floor-to-floor time.

HIGH-SPEED LIFE INSURANCE THROUGH ASSEMBLY BALANCING

Eliminates Unbalance Caused by Cumulative Tolerances of Component Parts



Gisholt DYNETRIC 3UJP Balancing Machine, showing balancing of jet engine rotor assembly. For consultation with engineering specialists on vibration or balancing problems, write Gisholt.

One of the reasons why today's jet pilots can fly with greater safety—at faster speeds and higher altitudes—is modern assembly balancing of their engines.

Here is a typical example. This Gisholt DYNETRIC 3UJP Balancing Machine is used to balance jet engine rotor assemblies, consisting of a turbine shaft, two turbine wheels, and a compressor which has been balanced before assembly. The entire rotor assembly is dynamically balanced to a tolerance of .50 ounce inches in the right plane, with correction made by removing stock from a balance-ring machined on the outside face of the second turbine wheel—and to a tolerance of .75 ounce inches in the left plane, with correction made by adding weight on the flange at the junction of the compressor and the turbine shaft. After balancing, the parts are match-marked and are then disassembled.

Assembly balancing permits balancing ultimate assembly as a unit, providing smoother-running, longer-lasting modern jet engines.

DYNETRIC BALANCERS GISHOLT

No. 7-856
657

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

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AVAILABLE FROM
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Five elements normally make up the formula of a grinding wheel—abrasive grain, size, grade, structure, and bond. But, in a Sterling wheel, you can get the *sixth* element.

This *sixth* element is the *human* element. It takes into consideration the important factors that never show up in a grinding wheel specification. These include the operator himself, how he works, and all the "little" things that make *your* grinding job different from all others. And it's surprising how much these factors can mean in money and performance.

To formulate for the sixth element, call in one of Sterling's skilled Abrasive Engineers or your nearest Sterling Distributor. Let him study your complete grinding operation and observe your operators.

Sterling's sixth element can mean big savings to you. Act now!

Grinding 4"-diameter boring-machine spindle.

"Wheels of Industry"—Vitrified and Resinoid—to meet the exact requirements of industry.

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Customer reports

81% average savings

in Machining Time with . . .

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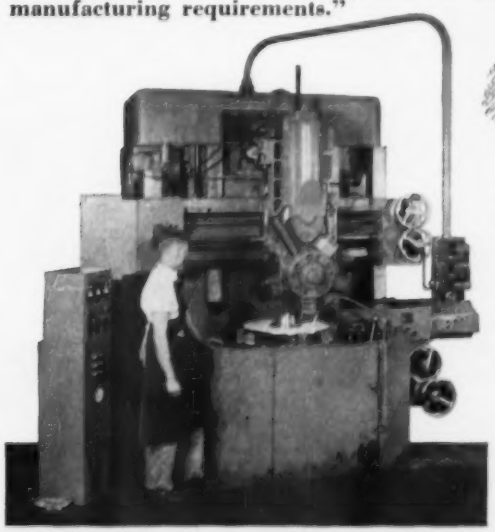
CUT MASTER V.T.L.

MODEL 75

At the York, Pennsylvania plant of the York Corporation, manufacturers of refrigeration and air conditioning equipment, the new 36″ Cut Master is running 24 hours a day machining hubs and covers for a turbo compressor impeller wheel.

They have calculated an 80% savings in machining time on the hub disc and 82.3% on the cover disc. As a result, the overall savings in all manufacturing operations for the turbo wheel amounts to 57.7%.

"The quality of the machined finish that we get with our new Cut Master, Model 75," says Mr. R. P. Feiser, Industrial Engineer, "is of such high standard that hand finishing is not necessary to meet our exacting manufacturing requirements."



These same savings can be applied to your manufacturing cost problems — for full information call your nearest Bullard Representative or mail coupon for Catalog to

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PLEASE SEND ME A COPY OF THE NEW CUT MASTER, V.T.L., Model 75 CATALOG

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NO SECONDARY OPERATIONS!

Stamping with folded lock seam produced complete on the

U. S. MULTI-SLIDE®

The part illustrated is a radio component. This formed metal stamping with folded lock seam is produced complete *without secondary handlings* on a No. 28 U. S. Multi-Slide at the rate of 175 per minute. The sequence of operations in the dies is illustrated by the strip layout at the top of the page. The operations in the four slide forming position are indicated by the drawings

Eliminate Secondary Operations and Reduce Costs: You, like all manufacturers, are interested in achieving this end result. The part illustrated is just one of many different types of formed metal stampings which can be produced complete on the U. S. Multi-Slide. If stampings are included in your production program, the U. S. Multi-Slide may be the answer to your cost reduction problems.

Ask for a copy of Bulletin No. 15-A containing complete specifications for the four sizes of Multi-Slides we now build.

DETAIL OF FINAL FORMING OPERATIONS

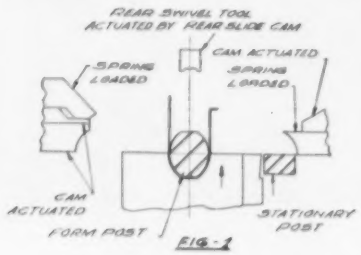


FIG-1

FIG-2

FIG-3

FIG-4

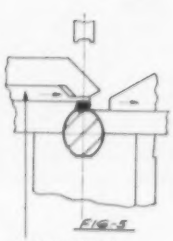


FIG-5

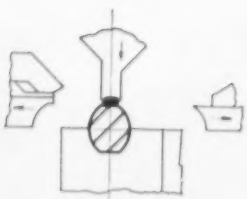
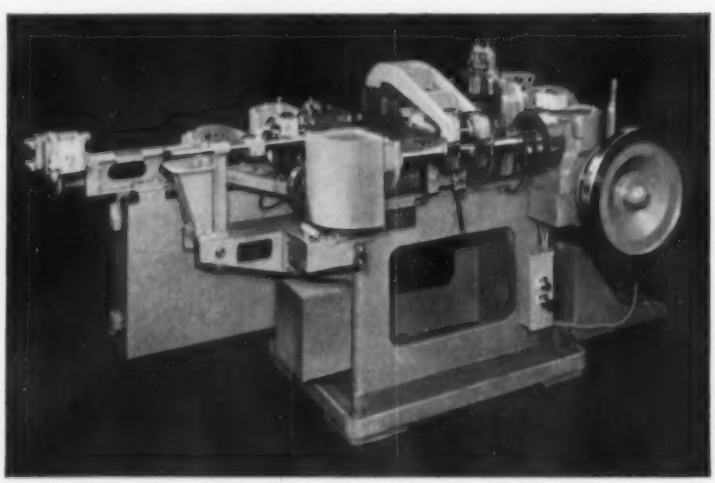


FIG-6

The No. 28 U. S. Multi-Slide, Symmetrical type, used to produce the radio component.



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Ampere (East Orange), N. J.

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U. S. Die Sets and Accessories

One hour

1800 lbs.-rough

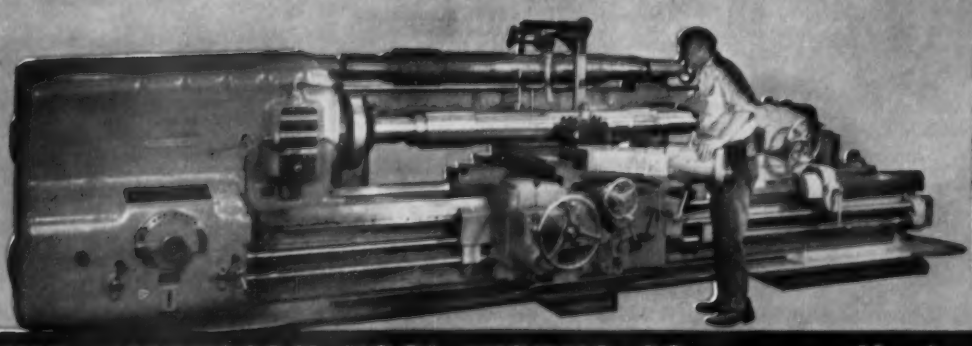
1300 lbs.-finished

One hour to finish turn this Diesel Locomotive Driving Axle from the rough forging, removing 500 pounds of chips and using 60 horse power cuts in the process.

This shows what a 25" "AMERICAN" Hydraulic Duplicating Lathe driven by a 50 H.P. motor can do. Production records of this kind are the rule rather than the exception and are being made daily.

"AMERICAN" Hydraulic Duplicating Lathes reduce machining time 50 to 75 per cent . . . cut costs to the bone . . . pay good dividends on the investment.

Repeat customers vouch for this in the most convincing way.



Bulletin No. 35 gives a complete description and shows many examples. It's yours for the asking.

THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

for accuracy in your production
it pays to specify

UNIVERSAL DRILL BUSHINGS

In Universal you get the best. Machined from finest quality steel. Blended radius on the top-inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip.

superfinish bores
lengthen tool life
The superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum—especially in close tolerance work.

Standard sizes and lengths in stock for immediate delivery. Contact the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

UNIVERSAL ENGINEERING COMPANY | FRANKENMUTH 1, MICHIGAN

on-the-job performance tests prove IT PAYS to specify MACKLIN MM segments

A complete line of Macklin Segments provide fast cutting action without burring or checking. Fit any standard chuck.

Macklin MM Segments give better cutting action on hard-to-grind steels and carbides.

Here's Proof . . .

Macklin MM Segments increased production per segment wheel 127% in a large machinery manufacturing plant which surface grinds steel and cast iron machinery parts. Look at these figures . . .

	Macklin	Competitive Wheel B
Number of pieces ground per segment wheel	392	173
Segment life	13 days	6½ days
Dressings required	112 (in 13 days)	65 (in 6½ days)

Here are other typical MM Segment Performance test summaries:

Product	Performance Record
Cast iron table tops	Macklin MM Segments, 1000 pcs. Comp. Wheel B, 400 pcs.
Miscellaneous metal parts	Macklin MM life 2½ times greater than Brand C.
SAE 1335 heat-treated steel	Macklin MM removed as much metal in 15 hours as Brand B removed in 35 hours.

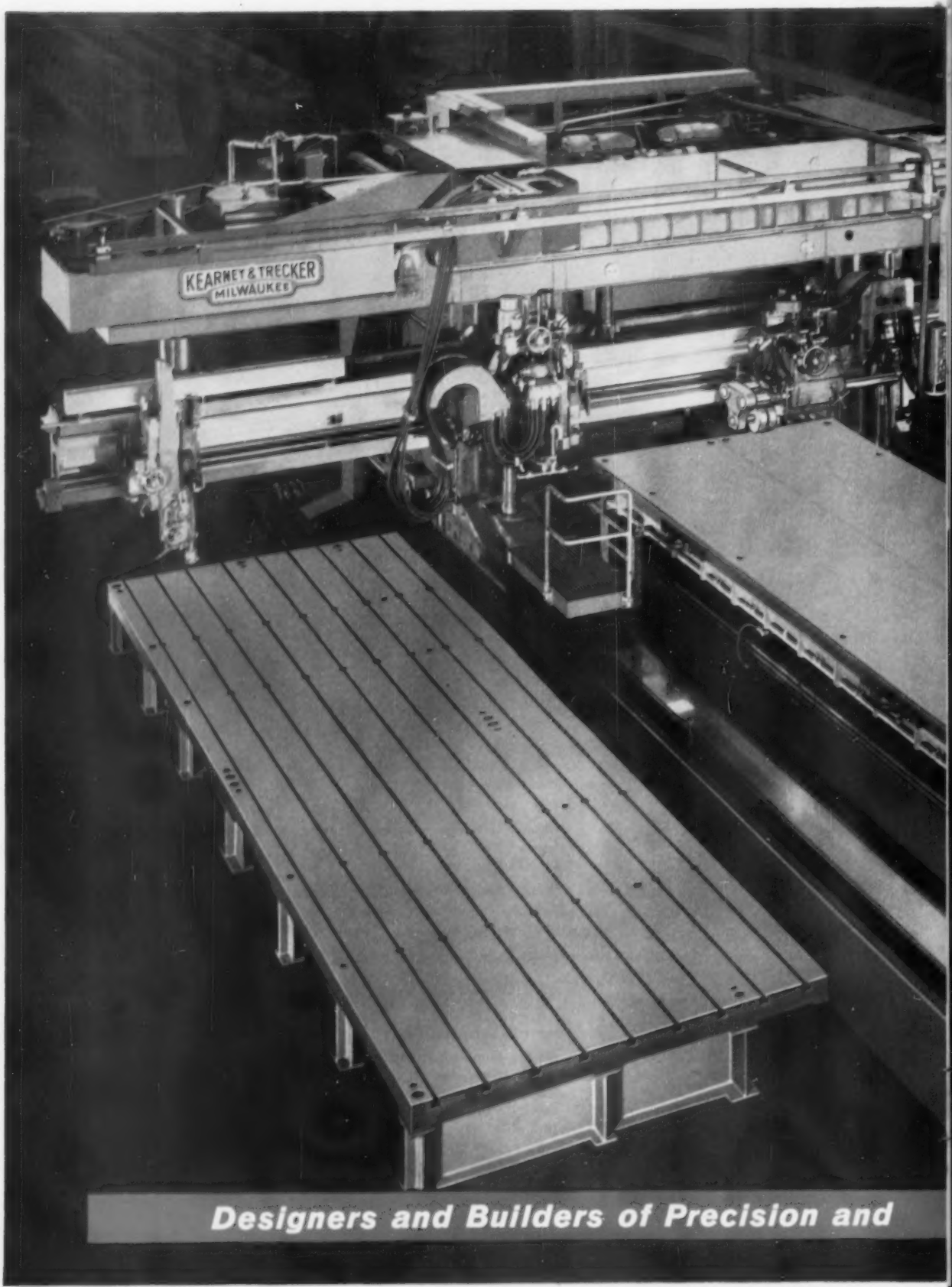
Here's why you get these results . . .

It's the unique MM construction consisting of a fine abrasive in pellet form which is engineered into MM Segments. This construction provides a constant flow of fine abrasive particles between the wheel and the work. The result? More metal removed per segment . . . fewer dressings required . . . and finer surface finishes.

But, don't take our word for it. Call your nearest Macklin distributor and arrange for a test on your own work. You'll be glad you did.

MACKLIN company

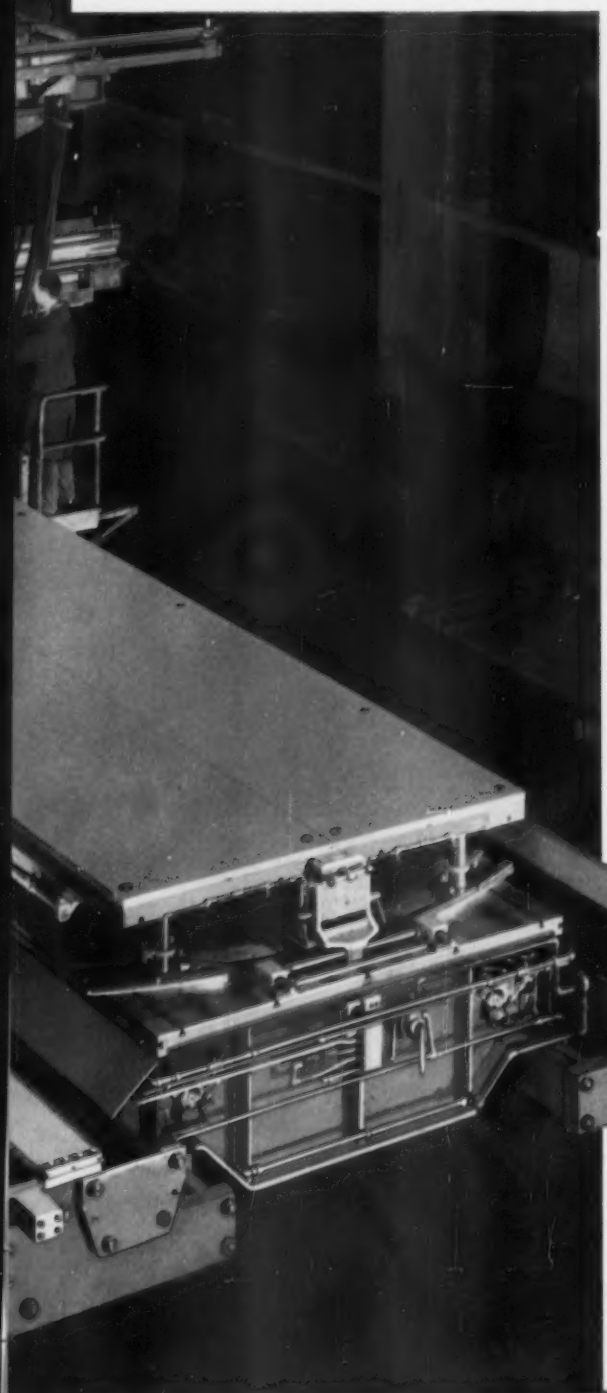
JACKSON, MICHIGAN


KEARNEY & TRECKER
MILWAUKEE
Designers and Builders of Precision and

Picture your workpiece on this 175-ton

KEARNEY & TRECKER MILWAUKEE

gantry type milling machine



THIS massive giant, 42 ft. long, 35 ft. wide, is equipped with electronic tracer control system designed for production milling of intricately contoured workpieces. Rugged enough to mill all metals . . . sensitive enough to hold close tolerances . . . it meets all A. I. A. specifications and has extendable bed design. Gantry type machine takes much less floor space and permits handling larger workpieces or multiple workpiece setups. Machine incorporates standard design components with automatic programming control systems available.

For more specific information on this gantry type milling machine, have our representative call at your convenience . . . or write to Kearney & Trecker, Special Machinery Division, 6786 West National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE

Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

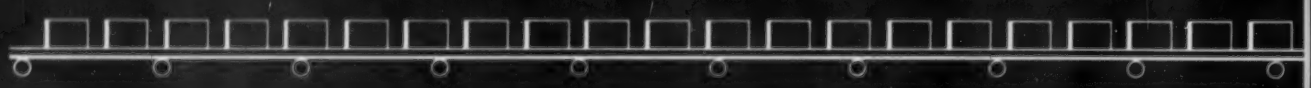
Production Machine Tools Since 1898

WHICH PRODUCTION PATTERN IS YOURS?

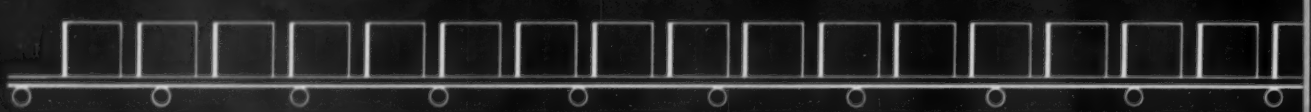
JOB LOTS—VARIETY OF SMALL PARTS

JOB LOTS—VARIETY OF LARGE PARTS

HIGH PRODUCTION—SAME SMALL PARTS



HIGH PRODUCTION—SAME LARGER PARTS



NOW . . . 4 NEW G-E INDUCTION HEATERS MATCH

You get maximum induction heater performance at minimum investment cost when you choose one of General Electric's new electronic induction heater models. Each model is tailored to one of the basic production patterns illustrated above. This lets you buy only the induction heating features you need for your particular production pattern.

In any one of the four ratings—7½-, 15-, 25-, 40-kw—you can choose a model to match your production pattern:

FOR HEATING SMALL AREAS the built-in output transformer is recommended. This feature enables you to couple power at maximum efficiency into a wide variety of low-impedance inductor coils.

FOR HEATING LARGER AREAS the tapped tank coil is recommended. The tap-adjustment feature lets you couple the heater power into a wide variety of high-impedance inductor coils.

FOR JOB-LOT PRODUCTION OF A WIDE VARIETY OF PARTS, variable power adjustment is recommended. Grid control of thyratron tubes permits manual adjustment of power under load from 0 to 100 per cent.

FOR HIGH-VOLUME PRODUCTION, IN WHICH YOU DO NOT HAVE RAPID CYCLING, the variable power adjustment feature is not needed. In these applications, the heater is adjusted initially to heat a specific part. No further adjustment is necessary until you change to a different part.

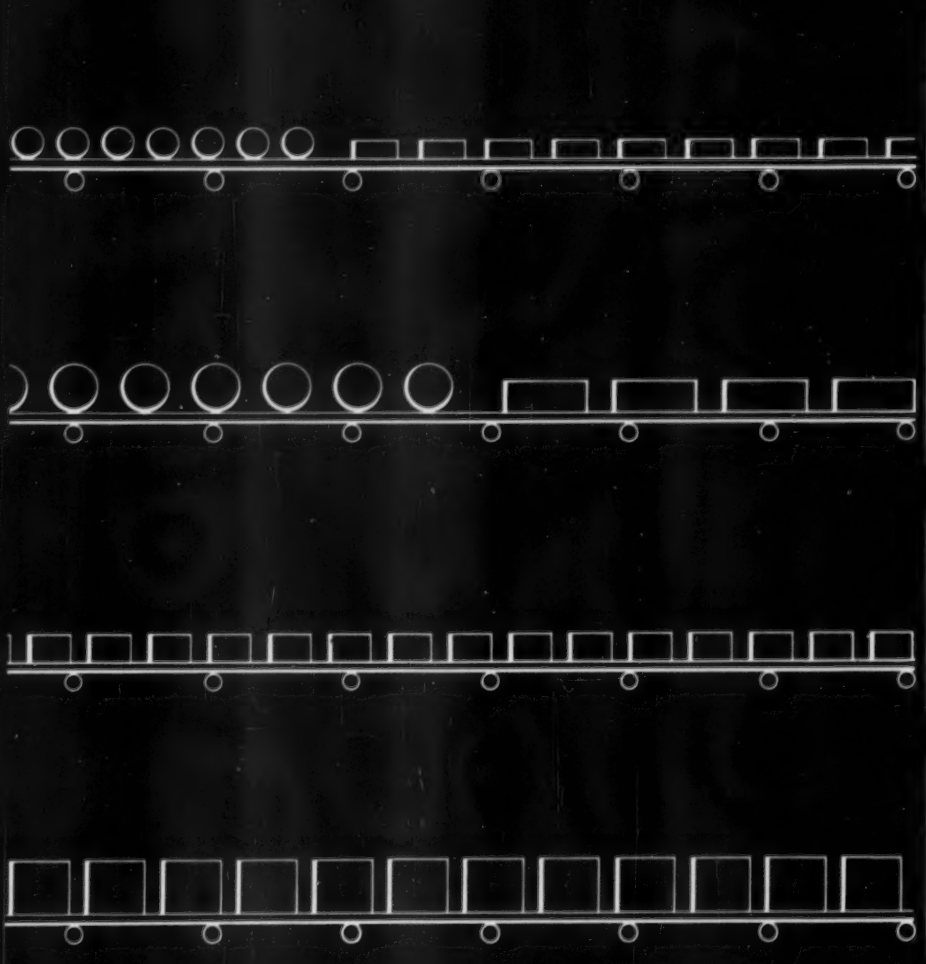
Features in any of the four ratings can be combined in the following fashion:

Model	Thyratron	Output Transformer	Tapped Tank Coil
4HM L1	x	x	
4HM L2		x	
4HM L3	x		x
4HM L4			x

Your nearby G-E Heating Specialist will help you choose the model best suited to your production pattern. You'll be paying only for those induction heater features you will use in your operation.

For specific bulletin information about these new induction heaters send in the coupon at the right.

GENERAL ELECTRIC



4HM L1

4HM L3

4HM L2

4HM L4

ANY PRODUCTION PATTERN . . . ECONOMICALLY

G.E. Gives You All These Features — and More!

DESIGN FEATURES	G.E.
High KVA Oscillator	✓
Built-in Water-to-air Heat Exchanger	✓
Readily Accessible for Maintenance	✓
Four Models in Each Rating	✓
Totally enclosed Aluminum Oscillator Box	✓
Dust-tight Cabinet Construction	✓
Industrial-type Oscillator Tubes	✓
Filament Voltage Regulation of ±3%	✓
Water Flow Switch to Protect Oscillator Tube	✓
Three Instruments on Control Panel	✓

FREE BULLETIN
Section F722-4
General Electric Company
Schenectady 5, New York

Please send me a copy of your bulletin "New G-E Electronic Induction Heaters" GEA-6388.

Name .....

Company .....

Street .....

City ..... **State** .....

GENERAL ELECTRIC

Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to ***"PUT IT ON THE BLANCHARD".***

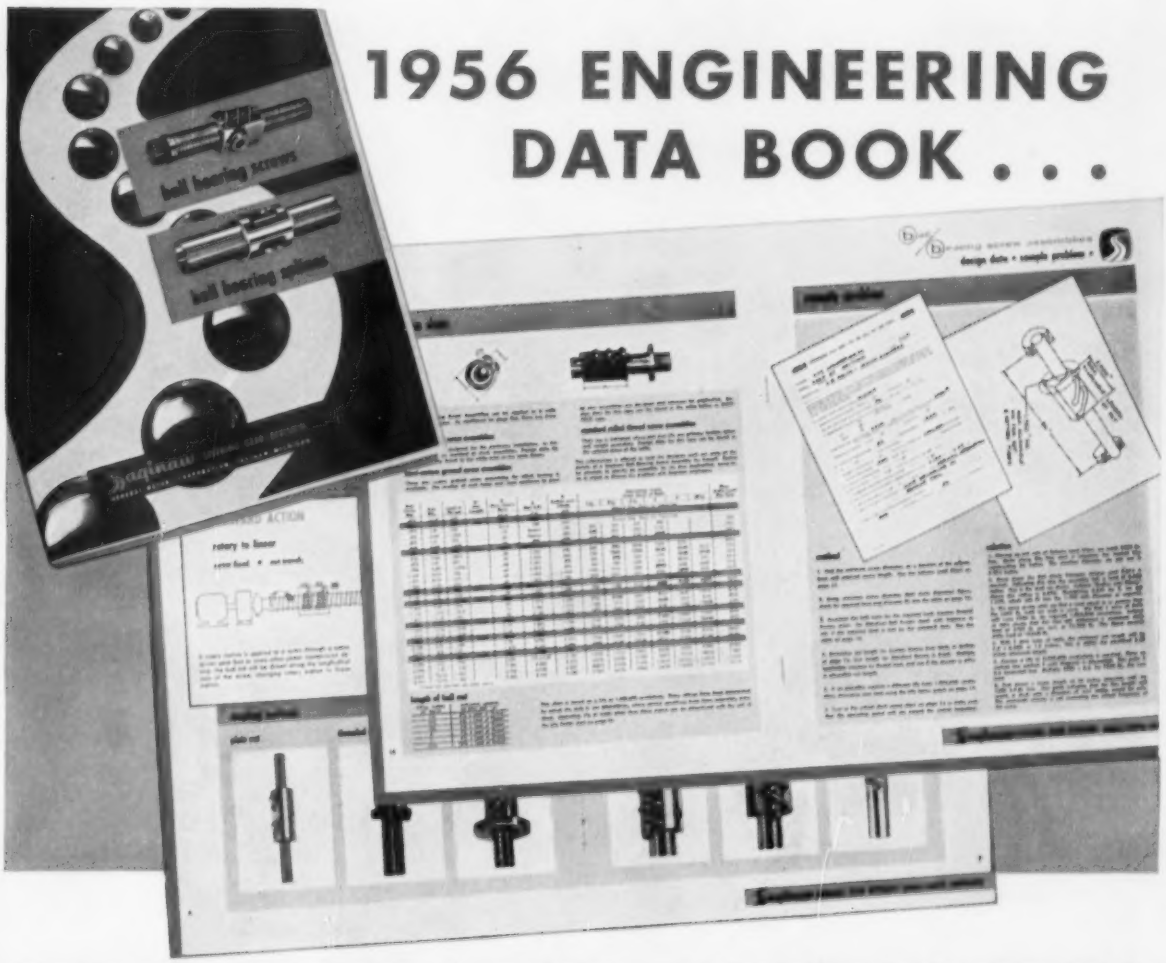
P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!

Send for free copies of "Work Done on the Blanchard"

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

1956 ENGINEERING DATA BOOK . . .



SHOWS HOW SAGINAW b/b SCREWS and SPLINES FREE YOU FROM DESIGN LIMITATIONS OF ORDINARY ACTUATORS and POSITIONERS

BOOK CONTENTS: Principle • Types • Basic Operations • Coupling Methods • Efficiency • Versatility • Advantages • Selection Factors • Charts: Expected Life, Critical Speed, Column Load • Design Data • Sample Problem • Typical Custom Assemblies • Standard Assemblies

SAGINAW b/b SCREWS are *90%-98% efficient* (compared to 15%-20% efficiency of Acme screws). Require 2/3 LESS torque and power for same linear output—with consequent weight, space reductions. Function normally at −75° to +400° F. Two types: precision-ground or economical rolled-thread. Have been built 1½ in. to 39½ ft. long.

SAGINAW b/b SPLINES have *40 times lower coefficient of friction* than sliding splines; transmit or restrain high torque loads far better; permit vital power, weight, space reductions. Have been designed 3 in. to 9 ft. long.

Saginaw ball bearing Screws & Splines

SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP., SAGINAW, MICH.

SEND COUPON FOR 32-PAGE ENGINEERING DATA BOOK

Saginaw Steering Gear Division, General Motors Corporation
b/b Screw and Spline Operation
Dept. 6R, Saginaw, Michigan

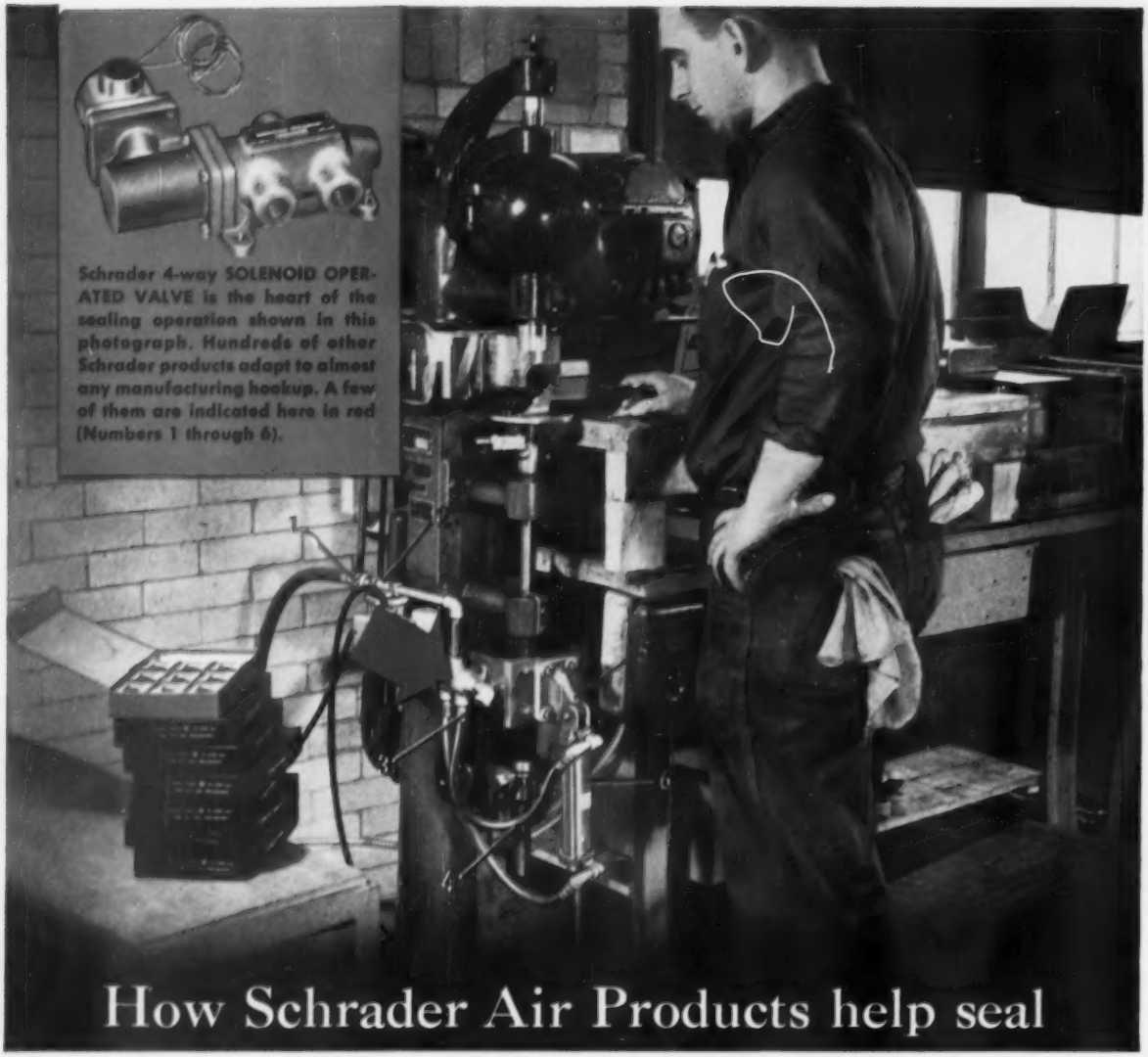
Please send new engineering data book on Saginaw b/b Screws and Splines to:

NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____


Schrader 4-way SOLENOID OPERATED VALVE is the heart of the sealing operation shown in this photograph. Hundreds of other Schrader products adapt to almost any manufacturing hookup. A few of them are indicated here in red (Numbers 1 through 6).

How Schrader Air Products help seal

5000 pellet boxes per day—3 times faster!

Box sealing is a common operation performed by compressed air. Just how speedy it can be is demonstrated at a New York arms manufacturing plant, where 5000 boxes of pellets are crimped tight each day. The back-breaking job of crimping by foot power is eliminated, and the operator does not become fatigued.

Wherever operations are automated—in holding or positioning work, moving scraps or chips, or synchronizing actions—air can help. By making these steps automatic, more efficient manufacturing is achieved.

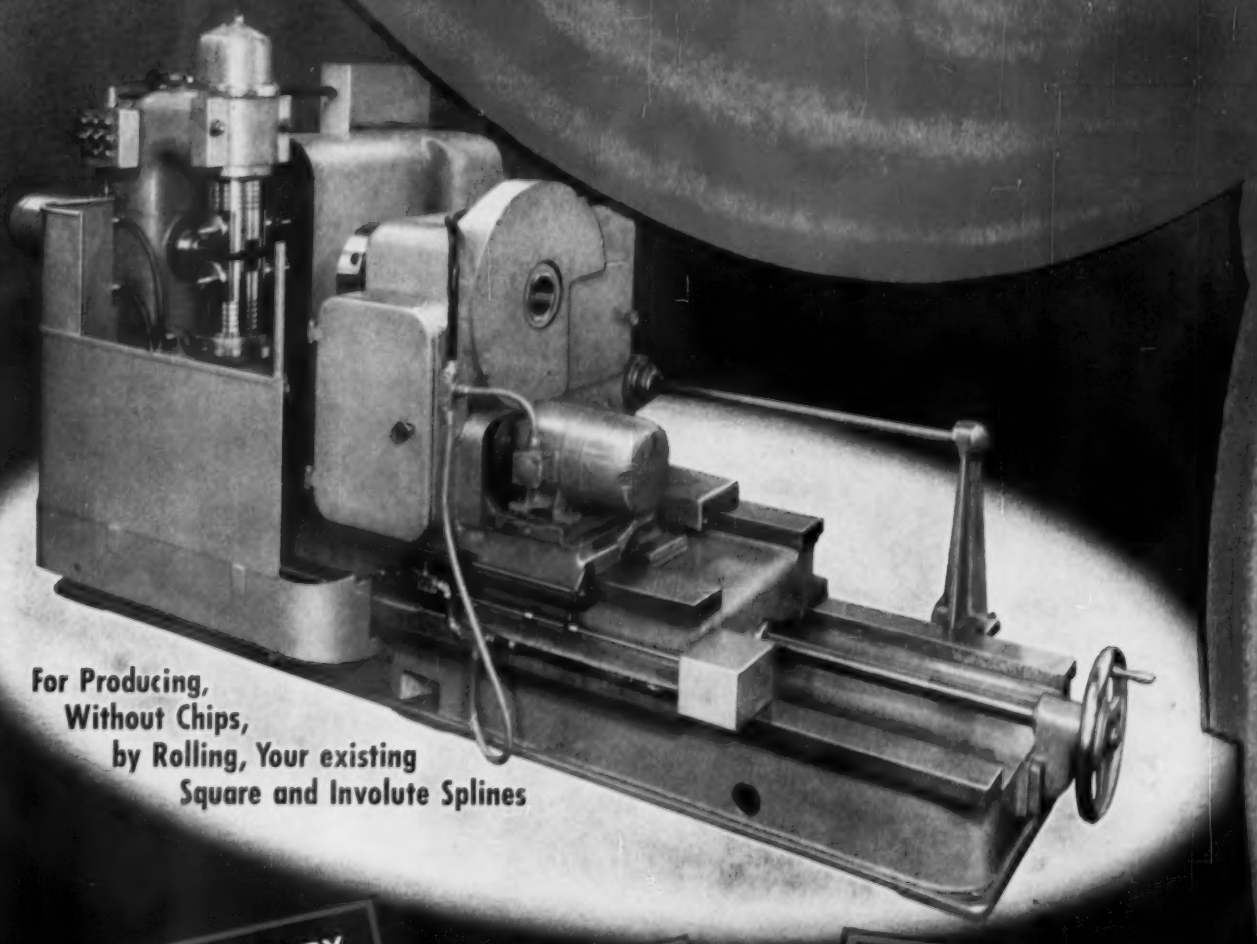
In many cases this can be done more economically with Schrader Air Products than in any other way. Upon request, Schrader engineers will assist you in planning for the most efficient use of air and in selecting the products best suited to your applications. Outline your problem to us . . . we'll be glad to help you. Or, send for the latest informative booklets which show Schrader Air Products that will help you increase production—economically.

Schrader®
ESTABLISHED IN 1844

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
460 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

Raising The Curtain On The LEES-BRADNER Manufactured, GROB PROCESS, SPLINE ROLLING MACHINE



For Producing,
Without Chips,
by Rolling, Your existing
Square and Involute Splines

REVOLUTIONARY

CHIPLESS

ACCURATE

FAST

ECONOMICAL

See reverse side for specifications and features

the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.

Here's Why True Rolling Is Better

No need to redesign—use your existing profiles.

Your existing splined profiles produced in 1/5 present hobbing times.

Forming roll costs about 1/9 of hob costs—"resharpening" costs eliminated!

No chips.

Manual loading or automatic self-loading and self-unloading, as you prefer.

Splines precision produced with amazing improvement in finish.

SPECIFICATIONS

Capacities

Root Diameter of work Max. 4" Min. ¾"

Between centers Max. 48"

Length of Spline Max. 9"

Diameter of hole through work holding spindle 6"

Work Spindle Speeds—1800 RPM divided by the number of teeth in the work

Motors—Main Motor 10 HP. Rapid Traverse Motor 5 HP. Rev. Feed Motor 5 HP. Pump Motor ½ HP.

Length 14 ft. Width 6'6" Height 6'0"

Weight (net) 15,000 lbs.

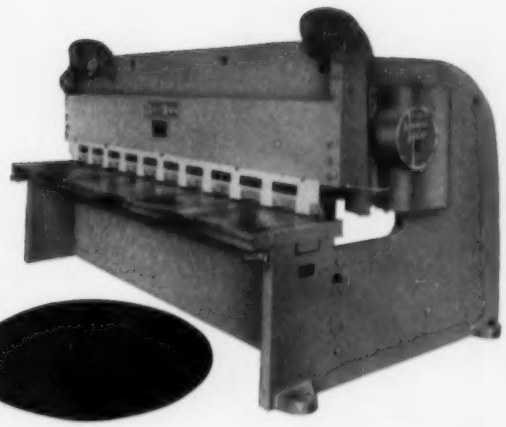
the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.

MODEL 8 HOBBER · NT THREAD MILLER · 7-HD ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · 5H SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

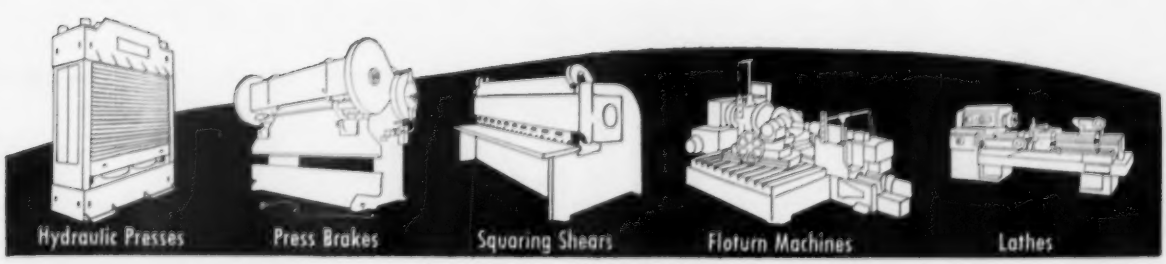
keep your
shear operators in the
production zone



WITH A LODGE & SHIPLEY POWER SQUARING SHEAR

There's one thing for sure about shearing. Keep the operator out front for maximum production! That's why one user calls the space in front of his Lodge & Shipley Shear the "Production Zone." With all adjustments in front and all clear behind the shear, the operator stays out front and on top of the shearing job. Necessary adjustments can be made quickly . . . scrap or cut pieces can be removed from the back of the shear by hand, truck or even conveyor. There are, of course, many other productioneered features in the New Lodge & Shipley Shears. For details, write for Bulletin PS-8:

The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio



DROODLES

by ROGER PRICE

J&L

Bench Model BC-14D

Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"SPLIT-LEVEL WIGWAM WITH PICTURE WINDOW"

This is the former abode of Little Ram's-Horn, the wampum counterfeiter. A nice guy, but *crooked!* Over the years, Little Ram's-Horn successfully strung up and disposed of bushels of bogus beads. But when his fellow Jiggersaws finally caught wise, he himself was strung up and disposed of. Suspicion was first aroused when he started wearing mink loincloths. Then, when he designed and built this swanky tepee, everybody *knew* he wasn't on the level.

I'm absolutely on the level when I say it's a good idea for all quality control and inspection men to investigate what a J & L Comparator can do for them. The J & L Comparator is a precision inspecting and measuring instrument, made to handle all sorts of parts and objects, in all sorts of sizes and shapes. This ingenious instrument is accurate to .0001", and is equally suited to both production-line and job-shop work. Besides, it enables you to perform inspections that are not possible by any other method. For complete information, write Dept. 710 *today*.

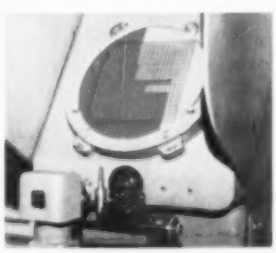
JONES & LAMSON OPTICAL COMPARATORS

Solve Production Bottleneck

Substantial increase in production of chemical process pumps by *Eco Engineering, Newark, N. J.* threw great pressure on the company's inspection department. Installation of a J & L Comparator allowed one semi-skilled operator to handle the work of six, and still keep pace with the expanded volume of components streaming from the production line.

The checking of 2000 neoprene impellers formerly required two ten-hour days. Now, with a J & L Comparator, they can be inspected for critical dimensions in two and one-half hours. Other parts, including eccentrics, shafts and impeller guides are checked for tolerances which vary with part function from .001" down to 0.0005".

Micrometric inspection of initial runs of machining operations keeps rejects at Eco to a minimum, and assures tight coordination and over-all efficiency along the production line.



JONES & LAMSON

World's Largest Manufacturer of Optical Comparators since 1919

JONES & LAMSON MACHINE COMPANY, 502 Clinton St., Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.

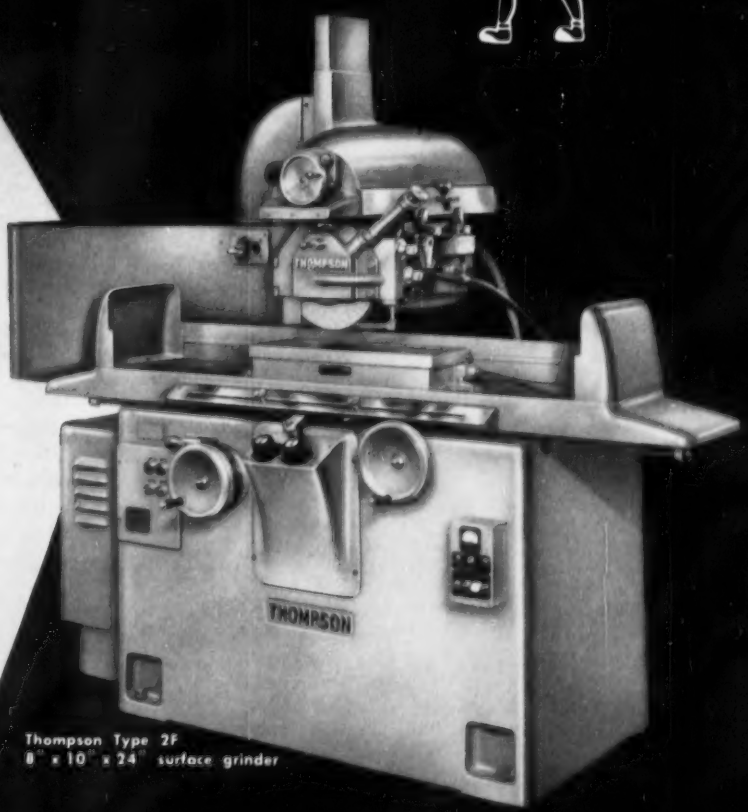
PRECISION PETE SAYS:

Only Thompson Type 2F Grinder has all three available . . .

1 COOLANT THRU THE WHEEL . . .

2 . . . COOLANT EXTERNALLY ON THE WORK . . .

3 . . . AND "IN POSITION" WHEEL TRUING



Thompson Type 2F
8" x 10" x 24" surface grinder

MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF SURFACE GRINDERS

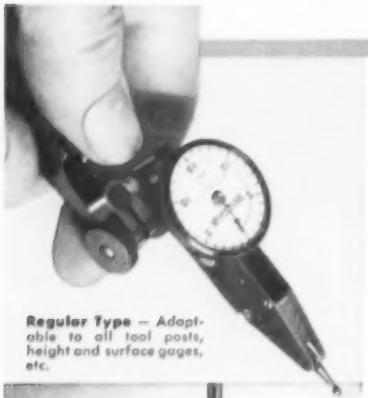
WRITE TODAY FOR DESCRIPTIVE DATA

THE THOMPSON GRINDER COMPANY
SPRINGFIELD, OHIO

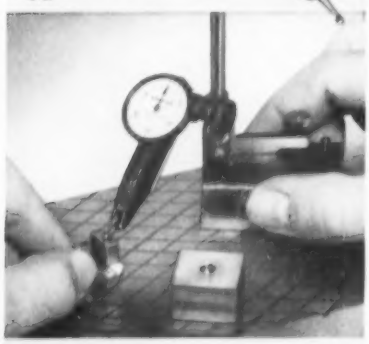
Thompson SURFACE Grinders

Copyright 1956 The Thompson Grinder Company

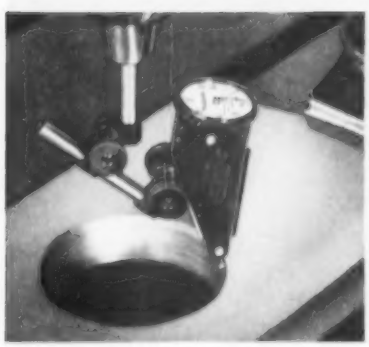
The World's Most Imitated FEDERAL TESTMASTER



Regular Type – Adaptable to all tool posts, height and surface gages, etc.



Perpendicular Type for use on jig borers, in deep holes, etc.



Copied in Foreign Countries and by nearly a dozen companies in the United States, it still offers more than any other!

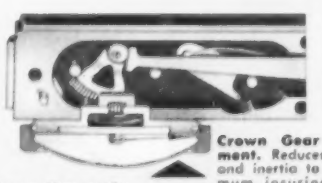
The Federal Testmaster, though extensively imitated, has never been equalled.

The crown gear movement which is original with these Indicators makes it possible to build-in the exceptionally high accuracy and sensitivity which are so valuable to users. Two different gear ratios are used — one for each model, graduated in .001" (Model 1) and .0001" (Model 2).

Contact pressure is extremely light. Contact points are ratchet-held for positive positioning.

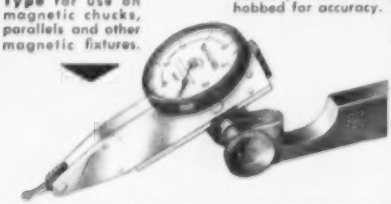
The Testmaster is simple to use, without complicated adapters that are not only cumbersome but also cause inaccuracies due to friction, lost motion and inertia. Ruggedly built for production inspection and exceptionally adaptable to the many tests required in general machine shop and tool room operations, the Testmaster has a thousand uses. Ask for illustrated bulletin.

FEDERAL PRODUCTS CORPORATION
6127 Eddy Street • Providence 1, R. I.

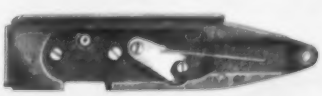


Crown Gear Movement. Reduces friction and inertia to a minimum insuring great accuracy. Gear teeth hobbed for accuracy.

Non - Magnetic Type for use on magnetic chucks, parallels and other magnetic fixtures.

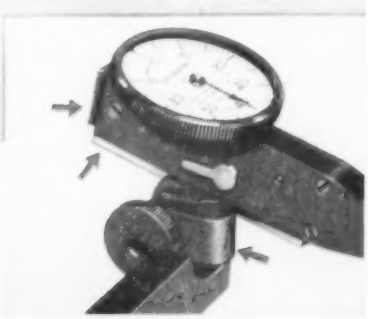


Dovetail Slides and Universal Clamp make Testmaster easiest to set and insure rigid support in any position. Dial rotates for quick setting.



Jewel Bearings – Vital bearings are jeweled to reduce friction and insure continued accuracy.

Index Point. Interchangeable. Ratchet design permits hard Chrome Plated Point to be reversed or set positively at any angle within 180° arc.

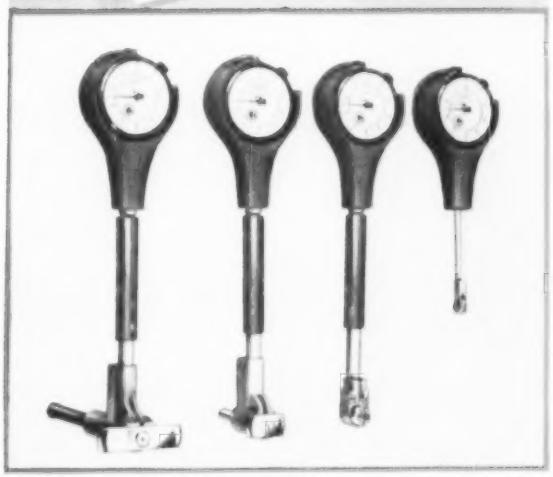


Ask FEDERAL *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

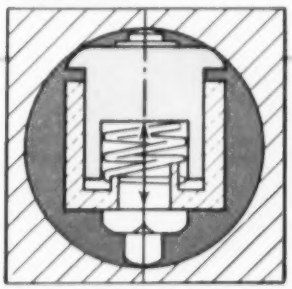
Copyright 1956 The Thompson Grinder Company



Four gages inspect all diameters from ½" to 8"

YOU SET IT DIRECTLY TO GAGE BLOCKS or with a micrometer . . .

Precise Centralization is Built-in



Positive centralization. Single plunger eliminates off-center location, assures precise alignment of centralizers and sensitive contact.

You can set this gage to gage blocks or micrometers with perfect assurance that when you place the gage in the hole the contacts will locate precisely on the true diameter.

Instead of using two separate centralizing plungers which might respond unequally to a common source of pressure, thereby making centralization inaccurate, the 1250 Series Bore Gages have a single, large, spherically radiused plunger which contacts the circumference of the hole at two points. The generous bearing surfaces assure precise movement of the plunger so that pressure is exerted equally at each point of contact, causing the gaging head to seat with greater accuracy on the true diameter of the hole.

At time of assembly, the sensitive and reference contacts of each gage are radiused precisely concentric with the plunger. This provides much greater accuracy than can be actually obtained by attempting to align a sensitive contact with two separate plungers. Even when the gage is unintentionally cocked laterally, it still holds its accurate centralization. Write for complete details.

FEDERAL PRODUCTS CORPORATION
6127 Eddy Street • Providence 1, R. I.

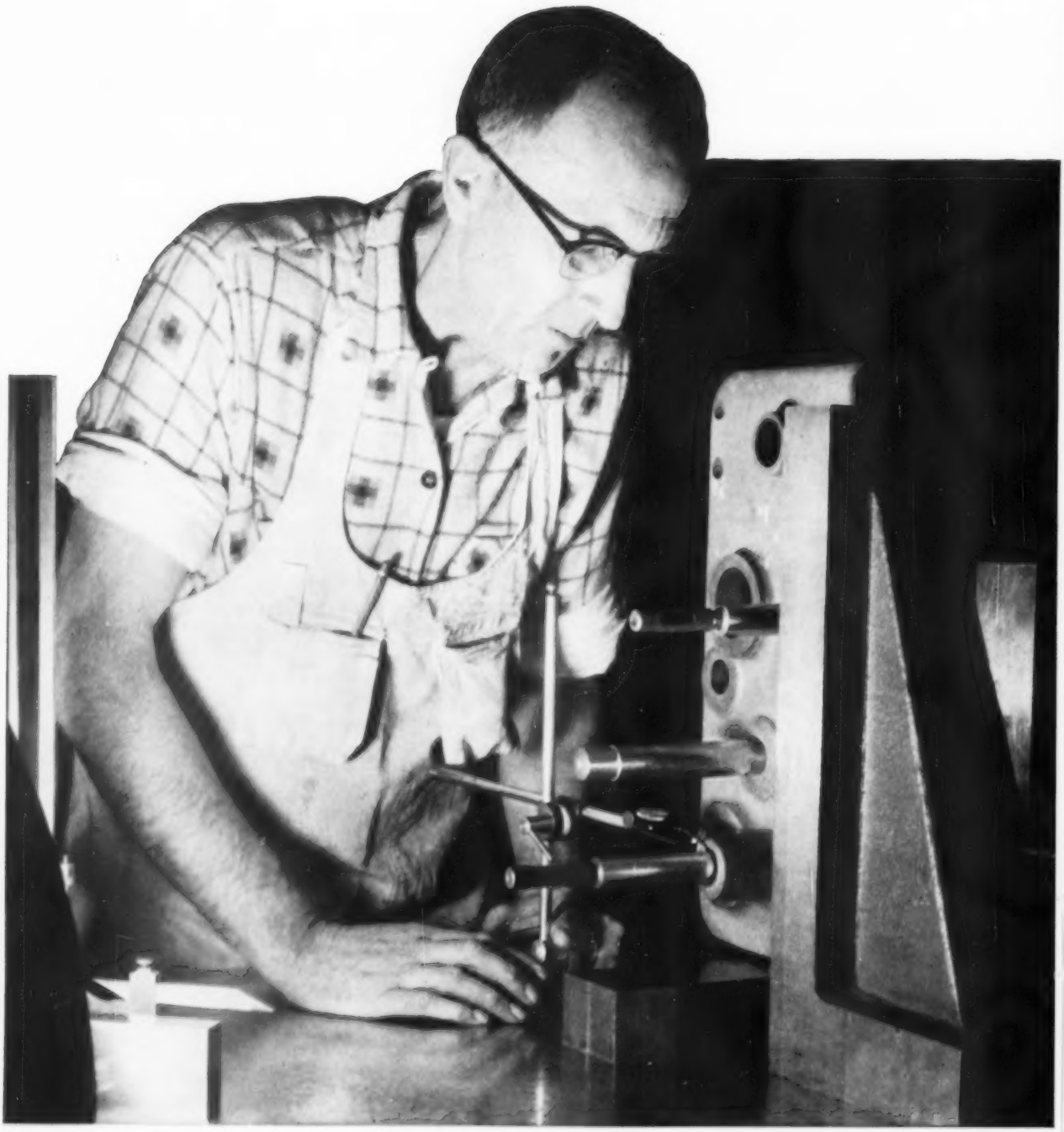
FEDERAL'S SOLUTION TO THE COST OF GAGING:
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

Something more



than precision...

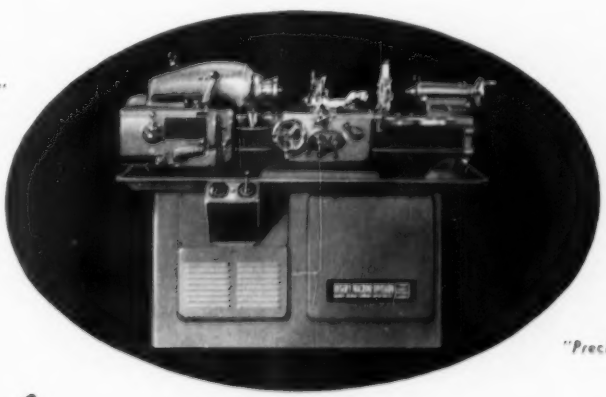
assures profitable production from your *Hendey* Tool and Gage-Makers' Lathe

You expect precision in today's machine tool — and you get it! But, when you buy a Hendey Lathe, you get an *extra measure* of painstaking care on the part of the builders. This assures quality production at output rates which make it a simple matter to turn a handsome profit.

On the opposite page, one of our skilled machinists is checking the accuracy of the apron of a 9 in. Tool and Gage-Makers' Lathe. He has mounted the apron over a dead flat surface plate and is using a plug gage and indicator to check alignment of the holes through the apron. Accurate location of the holes is also checked in the same setup by means of a height gage and indicator. This is typical of the keen attention to detail that marks each Hendey machine. When equipped with an electronically controlled or a magnetic amplifier drive, the Hendey 9 in. Tool and Gage-Makers' Lathe is capable of quiet, infinitely variable spindle speeds from 15 to 3000 rpm. Operator can change speeds smoothly even *during* a cut. The sensitive speed control is infinitely variable and provides full torque at low speeds. Another time- and money-saving feature is the electric dynamic brake which will stop the spindle within two seconds, even at maximum speed. Starting, stopping, and reversing the spindle from preset speeds are accomplished smoothly and rapidly.

These and other exclusive Hendey features mean precision with profit for your toolroom operations and a speedy return on your investment. Write your Hendey dealer for the complete story!

Hendey 9" x 24" Tool and Gage-Makers' Lathe



"Precision with Production"

Hendey **machine division**

BARBER-COLMAN COMPANY

71 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN ®

A-C Welders

LOW-COST SHOP WELDER (Model 20-S) 200 ampere A-C welder designed specifically for maintenance and repair of equipment or for light parts fabrication. Meets all NEMA specifications.

VERSATILE, PRODUCTION WELDER — (Model 200E) 200 ampere A-C light production welder. Full 75 open circuit volts — 60% duty cycle. Welding range from 30 to 350 amperes. Has all deluxe features.

FOR FARMS, GARAGES AND SMALL BUSINESSES — (Model U-18) 180 ampere, combination A-C welder and full 12 volt battery charger. Dual welding ranges for light or heavy gauges.

FOR TOP PRODUCTION AT LOW COST — (Model 300E) 300 ampere A-C production welder. Handles virtually all electrode diameters. All weather case.

End the "Power"

with A.O.Smith's line

Wide selection in both A-C and D-C welding machine lines helps you get the *right* machine for present work . . . sensible margin to handle future jobs. You pay only for the power you need.

YOU'LL find an A. O. Smith machine in virtually *every* amperage range . . . from 25 to 2500 amperes and in your choice of currents . . . A-C, D-C or Constant Potential. There are models available for manual, semi-automatic or completely automatic operation; for indoor or outdoor installations, and for light to extremely heavy-duty cycles.

In addition: (1) Every machine in the A. O. Smith line is insulated with silicone for greatest ability to withstand overloads and for increased resistance to corrosive or moist atmospheres. (2) All constant current machines have moving coil design for maximum safety, better welding characteristics, improved ventilation and longer life. (3) All have precision wound coils . . . stepless, easy-turning current control . . . high velocity ventilation and many other features designed to guarantee maximum performance and longer life.

Before you buy any welding machine, investigate this line in detail. You'll see why you buy better when you buy A. O. Smith job-matched power.

BUILT TO OUTLAST — TO OUTPERFORM — (Model 300) 300 ampere A-C heavy-duty production welder. More iron and copper plus silicone insulation make this model a workhorse.

FOR EVERY JOB IN YOUR PLANT — (Model 400E) 400 ampere A-C production welder with the widest ampere range in industry — from 75 to 585 amperes.

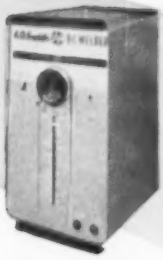
FOR THE FINEST IN PRODUCTION WELDING — (Model 400) 400 ampere A-C production welder. Handles sustained heavy loads without fear of machine damage. Production proved on industry's toughest jobs.

UNEQUALLED FOR QUALITY FEATURES — (Model 500) 500 ampere A-C production welder. Has all the deluxe features necessary for smooth, efficient operation and offers many extra years of machine life.

MANUAL OR AUTOMATIC WELDING (Model 650E) 650 ampere A-C welder. Singly or in series — specifically designed for the shop that cannot afford inflexible automatic equipment.

D-C Welders

D-C WELDING AT LOWEST COST (Model 2000) 200 ampere D-C production welder. 80 open circuit volts — 60% duty cycle. Welding range 25 to 345 amperes. NEMA rated.



INDUSTRY'S MOST VERSATILE D-C WELDER — (Model 3000) 300 ampere D-C rectifier. Has four different arc characteristics at the flip of a switch. Positive thermal overload protection.

FOR YOUR TOUGHER D-C JOBS (Model 4000) 400 ampere D-C rectifier with exclusive downdraft ventilation. Smooth arc — forcing arc and arc booster selection are but a few of its features.

MANUAL OR AUTOMATIC D-C WELDING— (Model 6000) 600 ampere D-C rectifier. A versatile, all-purpose D-C power source. Particularly suitable for use with C-OMATIC or C-OMANUAL.

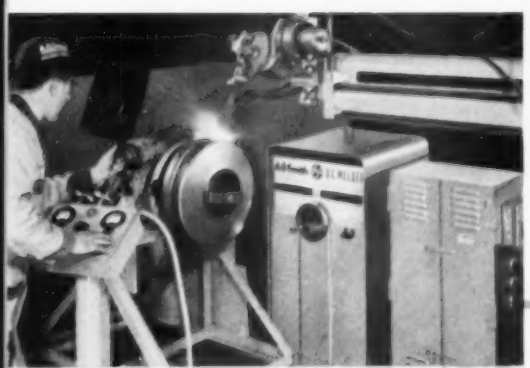
Guessing Game"

of job-matched welders

FOR INERT GAS AND SUBMERGED ARC — (Model 600CP). Full 600 ampere constant potential welder. Zero to 45.4 voltage range. Built-in 110 volt power supply — superior voltage regulation.

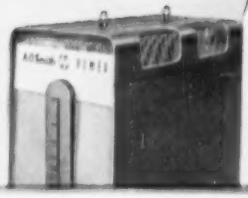
FOR WELDING . . . FOR POWER (Model 10,000) 1000 ampere D-C rectifier power unit designed to replace motor generator equipment. Use as a high-amperage D-C welder or as a compact power source.

COMPACT CONSTANT POTENTIAL POWER — (Model 1500CP) 1500 ampere C.P. welder for multiple operator use (10 to 16 welders). Designed to augment or replace existing motor generators.



1250 AMPERE D-C POWER — (Complete information available on request).

2500 AMPERE D-C POWER — (Complete information available on request).



C-OMATIC — for automatic welding saving thousands of dollars annually over Helium or Argon. Easy to set up, easy to use. Includes control console, remote control stand, automatic head and A. O. Smith 600-amp D-C power.

Plus C-OMATIC and C-OMANUAL...

not only the first and finest in carbon dioxide processes, but the fastest, most economical of all gas-shielded arc processes.

C-OMANUAL — new carbon dioxide, hand gun process puts manual welding on a virtual mass production basis. Includes lightweight hand gun which automatically compensates for arc length, portable control console and special A. O. Smith D-C rectifier.

Through research A.O. Smith *...a better way*

A.O.Smith

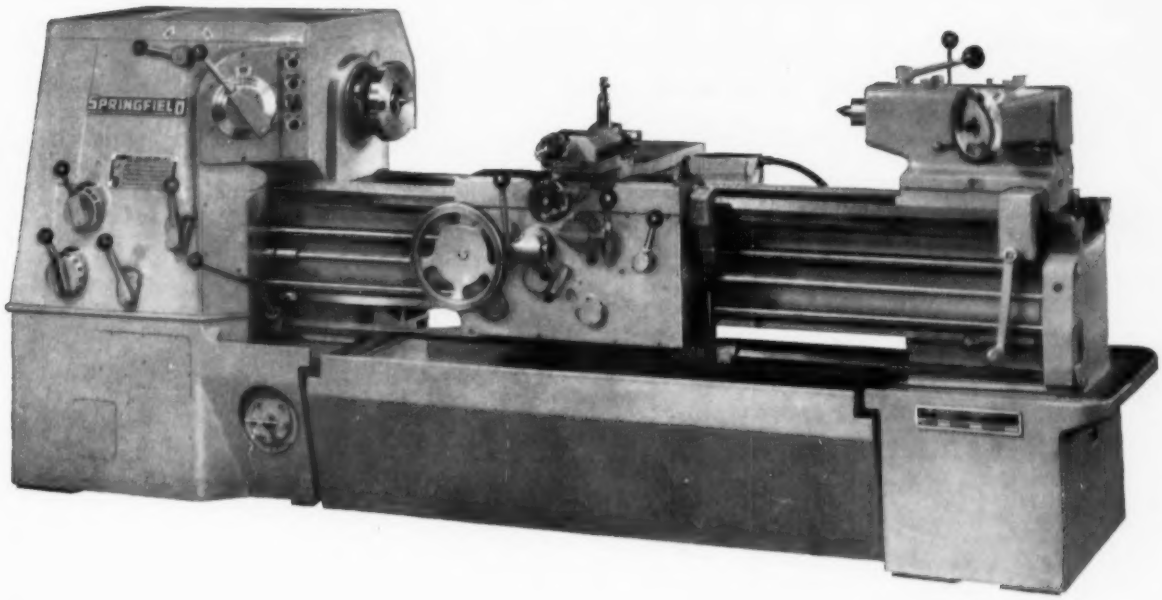
CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

INTERNATIONAL DIVISION, MILWAUKEE 1, U. S. A.

SPRINGFIELD



more useful horsepower

All the horsepower in a Springfield Model "S" Lathe is productive.
A simple, straight-forward gear train, plus double-action lubrication, plus tight dynamic balance tolerances (.0005" displacement) eliminate friction and vibration, the twin horsepower thieves.
In the headstock, only the gears necessary to a given speed are engaged. Other gears run free with a stabilizing flywheel action, no drag on power.
A high pressure filtered oil mist keeps all gears and bearings drenched, and a cascade of oil lubricates the feed box.

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".
Vertical Universal Grinders: swings 18" to 42".

The Springfield Machine Tool Company
Springfield, Ohio

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

SPRINGFIELD

Time Tested

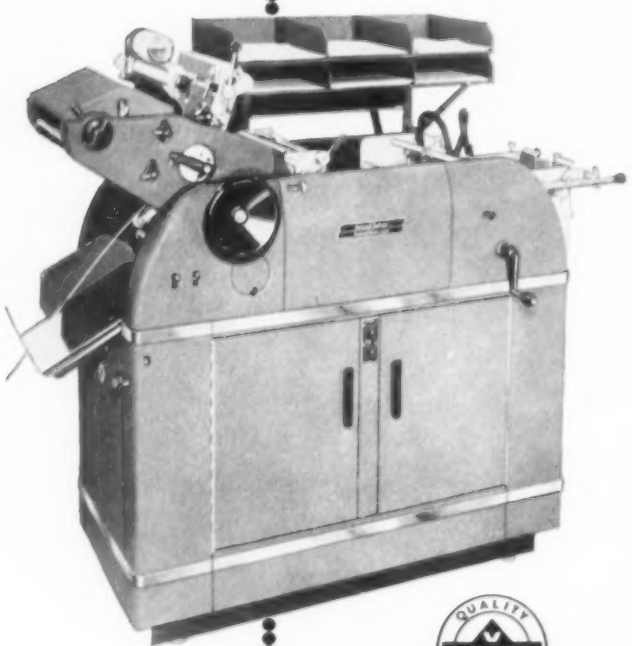
ADDRESSOGRAPH-MULTIGRAPH BUSINESS MACHINES

are created with quality in mind

... that's why **YOUNGSTOWN STEEL**

is specified as a basic material

Multigraph **Multilith Offset** Duplicator, one of many production machines for business records manufactured by Addressograph-Multigraph Corporation, Cleveland, Ohio.



It's apparent in many quality products you see every day: Perfection of manufacture starts with the basic material. And, with Addressograph-Multigraph, as with many other quality manufacturers, a basic material is Youngstown Steel—cold finished bars and cold rolled sheets.

Youngstown Cold Finished Bars have desirable uniformity and machineability. Injurious seams, cracks and other imperfections do not occur. Youngstown Cold Rolled Sheets have the right temper that makes them easier to form. That means fewer rejects and better fabricated products.

You are hours, dollars and energy ahead when you specify Youngstown. Get in touch with our nearest Youngstown District Sales Office for complete information.

QUALITY YOUNGSTOWN SERVICE

Youngstown COLD FINISHED BARS COLD ROLLED SHEETS

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

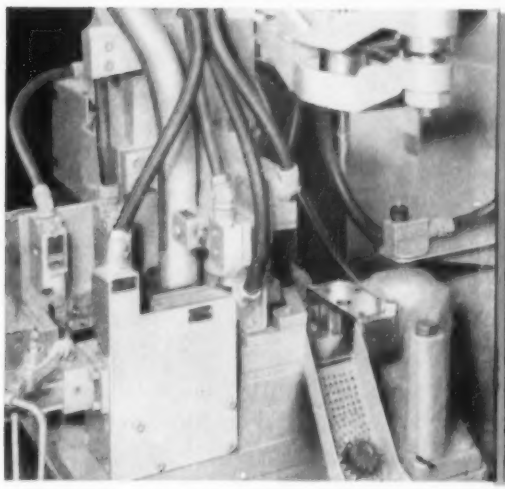
SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

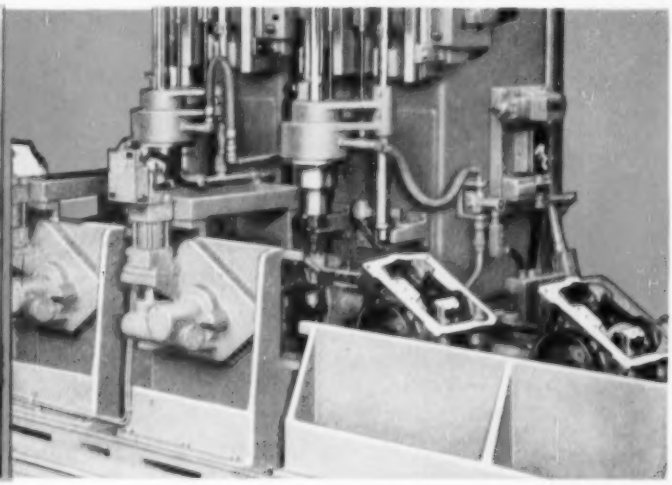
for connecting rods, gear bores, or other parts requiring high speed automatic production

automated honing

Full Automation

Loading
Clamping
Honing
Sizing
Unclamping
Unloading
Gaging and Selecting





BarnesdriL Honing Machines for specific production applications are arranged with fully automatic loading and processing cycle. Parts with oversize bores unsuited for honing are automatically rejected, and selected parts advanced to the honing position. Parts are honed and sized to preselected tolerances, and finish, and then discharged automatically.

All steps in the cycle are under cycle-control. Stock is removed, surface selectively finished, precision bore-to-bore sizing guaranteed, all within the automatic cycle. BarnesdriL exclusive control over abrasive wear eliminates size differences bore-to-bore. Honing stone design provides cutting support right up to the cutting edge, for longer life and free cutting action.

Consult a BarnesdriL engineer for application of automatic controlled sizing and finishing for your high production parts.

DETROIT OFFICE — 3419 South Telegraph Road, Dearborn, Michigan

BARNES DRILL CO.

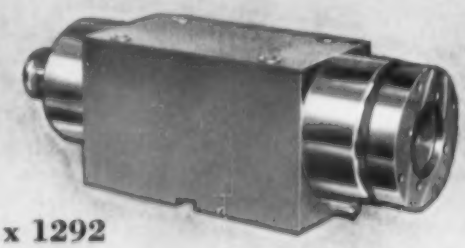
830 CHESTNUT STREET ● ROCKFORD, ILLINOIS

PARKER SPINDLES

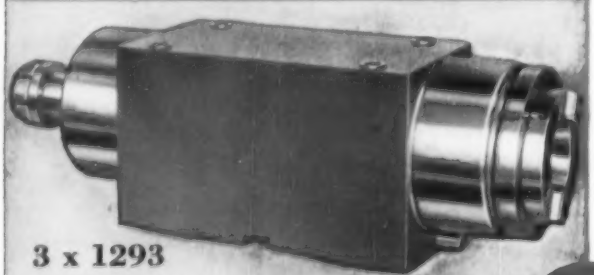
FOR PRECISION BORING, MILLING AND GUN DRILLING APPLICATIONS

3 x 1290

3 x 1291



3 x 1292



3 x 1293

Versatile—Economical

NO BETTER REASON for the success of Parker-Majestic in the design and manufacture of machine tool equipment can be found than in the acceptance of its versatile 3x1290 series of standard boring, gun drilling and milling spindles.

●

FOUR BASIC BODY SIZES, with modifications of spindle shaft and bearing design, make possible more than 75 spindles, for almost any application in which spindles are used, with speed ranges from a few RPM up to 10,000.

●

YOUR CHOICE OF SHAFTS: 1. Flange head, no shaft hole; 2. Flange head, shaft hole with rear I.D. threaded for rotary coupling; and 3. Milling machine taper head with shaft hole for draw bar.

●

MILLING MACHINE TAPERS are No. 30, 40 or 50, depending upon size of spindle.

●

DESIGN STANDARDIZATION gives you advantages of economical prices, prompt delivery.

●

WRITE TODAY for complete information, giving application, material, finish required, amount of stock to be removed. Also send part print, if possible.

PARKER-MAJESTIC PM PRECISION MACHINES

147 Joseph Campau • Detroit 7, Michigan

For the newest in coated abrasives . . . watch BEHR-MANNING!

Behr-Manning Abrasive belts speed production all along the line.

Behr-Manning Specialties are naturals for hard-to-get-at areas.

Behr-cat pressure-sensitive tapes are favorites in plants everywhere.

Smoothing-the-way to better surfaces

With BEHR-MANNING SPEED-WET METALITE Fibre Discs on the business end of your grinder, you'll breeze through surface preparation jobs in a jiffy. In addition, these rugged, sharp-cutting discs assure increased grinding mileage on the roughest of jobs. The combination of tough Aluminum Oxide grit, a DURABONDED adhesive, and the all-fibre backing make this possible. Try them on your next grinding operation. Your local Behr-Manning Field Engineer will gladly demonstrate, or write Behr-Manning Co., Troy, N. Y., Dept. AM-7.

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BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING CO.
BEHR-MANNING ® A DIVISION OF NORTON ABRASIVES

G-8

Beat Production Dead-Lines with a WILLIAMS-WHITE Double-End BENDER and STRAIGHTENER

5235

The two moving crossheads of the WILLIAMS-WHITE Hydraulic Double-End Bender and Straightener make it possible to bend or straighten either or both sides of a section. This feature . . . the sensitive control, adjustable stroke and cushioned "squeeze" provided by the hydraulic unit reduces handling, increases production in any shop in which bending or straightening operations are performed.

For more information, see our Representative nearest you or write us direct.

5490

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ALLIED NORTHWEST
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EDWARD A. LYNCH MACHINERY CO.
Wynnewood, Philadelphia, Pa.

GEORGE A. DAVIES, Jr. MACHINERY CO.
Los Angeles, Calif.

SPECIFICATIONS:

	5235	5490
Capacity, in either direction	75 tons	75 tons
Stroke, maximum	8 inches	12 inches

(5490: Bending blocks adjustable by operating hand wheel)

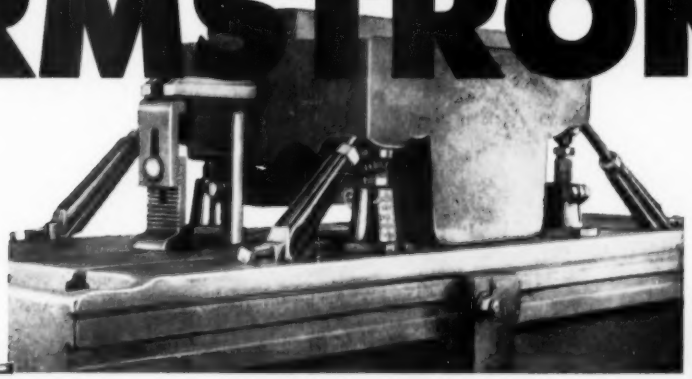
BUILDERS OF MACHINERY SINCE 1854

WILLIAMS-WHITE & Co.

304 EIGHTH ST. • MOLINE, ILLINOIS

PRESSES • BULLDOZERS • BENDERS • PUNCHES • SHEARS

ARMSTRONG



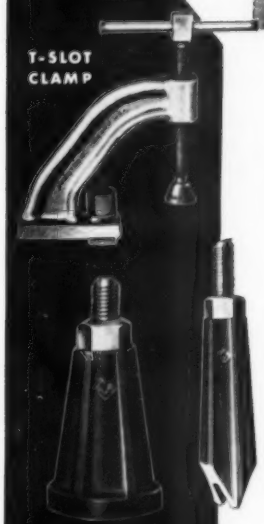
T-SLOT CLAMP

STEP BLOCK

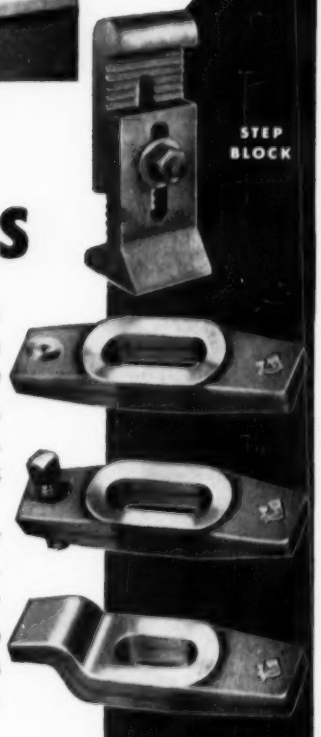
SET-UP AND HOLD-DOWN TOOLS

ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.



NON-SKID



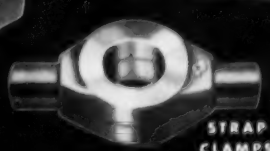
Write for Circular

Buy ARMSTRONG TOOLS from your Industrial Distributor

PLANER JACKS

UNIVERSAL CLAMP

T-SLOT BOLTS AND NUTS



STRAP CLAMPS

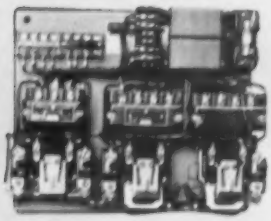
ARMSTRONG BROS. TOOL CO.

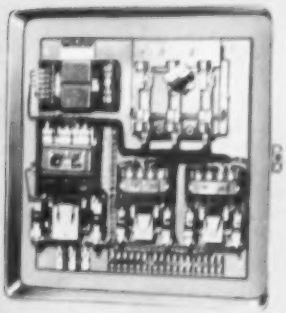
"The Tool Holder People"

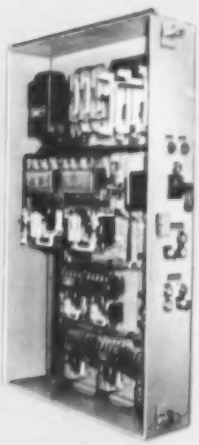
5215 W. ARMSTRONG AVE. CHICAGO 30, U. S. A.

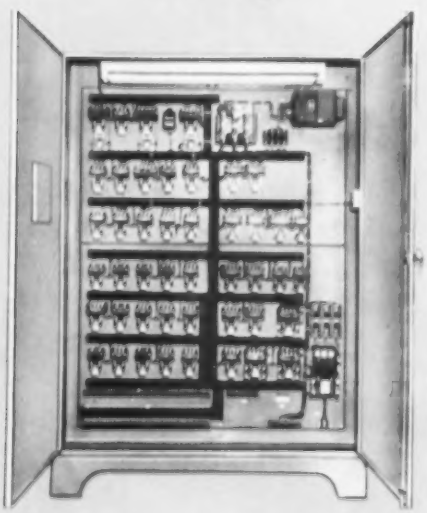
G-E general purpose control on

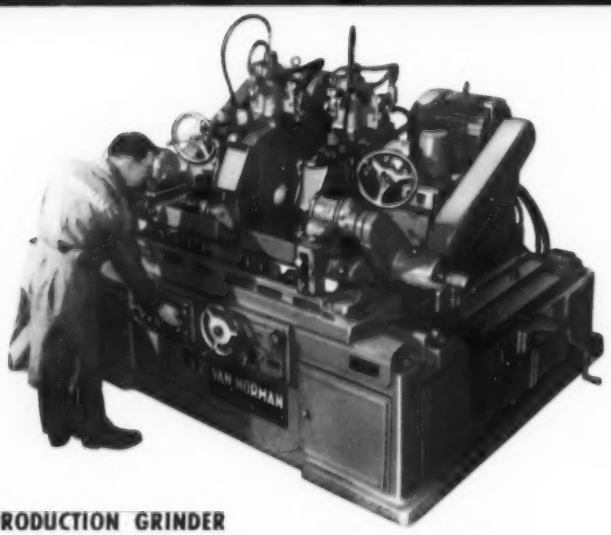
TYPICAL PANELS











NEW HIGH PRODUCTION GRINDER
EQUIPPED WITH G-E CONTROL HOLDS 15 MICROINCH FINISH

This new Van Norman Bowgage Production Grinder is designed for high production grinding of any part that can be readily chucked. The grinder can remove 0.022-inch on a 1⅜-inch diameter piece, hold a 15 microinch finish, and with operator initiated automatic clamping can have a new piece ready for grinding every 15 seconds.

Manufactured by the Van Norman Machine Co., Springfield, Mass., the Bowgage Production Grinder provides the equivalent of two Single Head Production Grinders on a single base. This reduces the floor space required, operator fatigue, handling time, and maintenance.

machines for industry

NEW G-E PAN-A-TROL* PANELS

A new program for packaged machine control from General Electric

Pan-A-trol panels are the focal point of a new program from General Electric for packaged machine control. This program, which places a new emphasis on panels for the dynamic automation age, features outstanding service to customers. The Pan-A-trol name distinguishes these panels which are applied to machines with a maximum rating of 200 horsepower, 600 volts, a-c.

This new program emphasizes the General Electric services available to you with Pan-A-trol packaged control. An enlarged engineering staff is ready to work with you on developing a circuit and panel design to meet your machine requirements. These G-E engineers can also help you take advantage of cost reductions due to repetitive or quantity Pan-A-trol orders.

Faster and better factory service is provided by expanded manufacturing facilities. Up-to-date equipment and skilled employees assure you of fast, prompt shipment. And, of course, General Electric's field service organizations assure your customers of fast local service if desired.

PAN-A-TROL NAMEPLATE identifies each panel. Built from your specifications, these panels offer you the installation, maintenance, and reduced stocking benefits of packaged control.

See your G-E Apparatus Salesman about this new program, and let him tell you how you can benefit from Pan-A-trol packaged control. **And, write Section 731-3 for bulletin GEA-6334.** General Purpose Control Department, General Electric Company, Bloomington, Illinois.

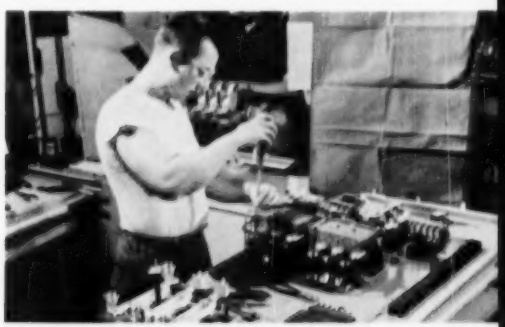
*Reg. trade-name of General Electric Co.

Progress Is Our Most Important Product

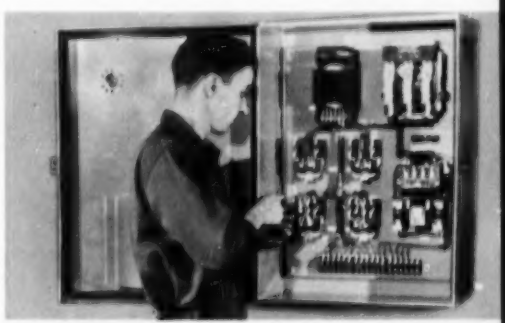
GENERAL ELECTRIC

4 WAYS TO BENEFIT WITH PAN-A-TROL PANELS

ENGINEERING ASSISTANCE. An enlarged staff of General Electric engineers in the factory and local offices are ready to help you with Pan-A-trol panels for specific applications.



MANUFACTURING FACILITIES. Skilled employees in new, enlarged factory facilities with the latest manufacturing methods assure fast, prompt shipment for Pan-A-trol control panels.



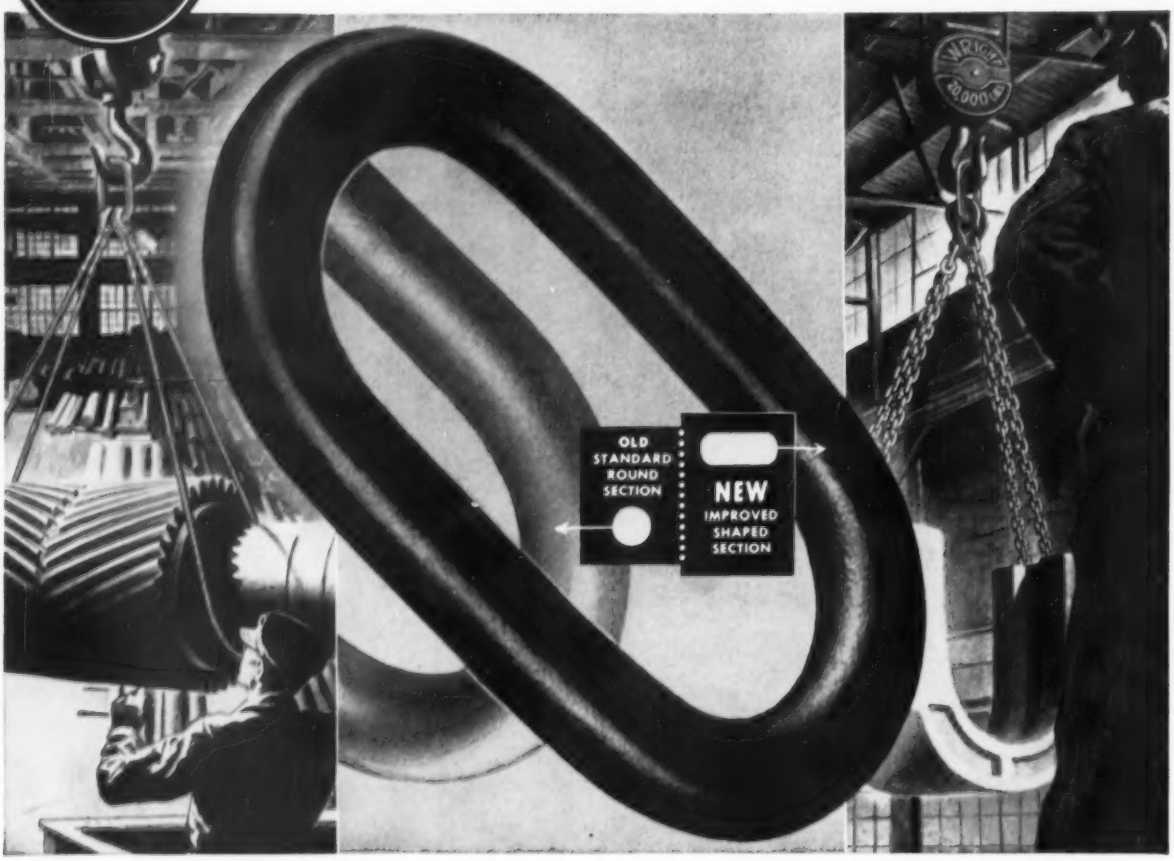
UNIT DESIGN. Pan-A-trol packaged control combines circuit design, device selection and arrangement into one coordinated unit. Only connections to rest of machine need be made.

PAN-A-TROL QUALITY. High-quality components and construction, backed by General Electric's field services, assure long dependable performance with Pan-A-trol packaged control.

ACCO products

ACCO Registered* Slings–Wire Rope & Chain

THE STANDARD OF EFFICIENCY AND SAFETY



An Extra Bonus of Safety for Slings—
THIS NEW SHAPED MASTER LINK

• ACCO's engineers found that if they shaped the master links for chain and wire rope slings as shown above, these new shaped links would hold their form under loads up to 18% greater than could the old standard round links. The reasons are similar to those which enable a shaped I-Beam to handle greater loads than could the same amount of steel if used as a solid beam.

The new link is smoother and provides a greater factor of safety. It is a better link in many ways. It costs us more to make. Yet it is offered at no increase in price.

"Registered*"—for Greater Safety

Development of this new link is just the latest step in ACCO's continuing program to provide the greatest possible measure of safety and reliability in ACCO *Registered* Slings.

Each component of an ACCO *Registered* Sling is made from the best materials procurable for its use. Each part must prove to have strength equal to or greater than the sling body. All hooks for ACCO *Registered* Slings are Magnaflux tested. Then these components are assembled into slings according to carefully engineered designs that have proved themselves in rigorous field tests.

The completed sling is then individually proof-tested to twice the working load limit for which it is rated. Then, and only then, is it awarded the coveted ACCO Registration Certificate and the identifying ring or tag.

See your Distributor

ACCO *Registered* Slings are readily available from a distributor near you. If you don't know him write to our Bridgeport office for his name.

*Trade Mark Registered

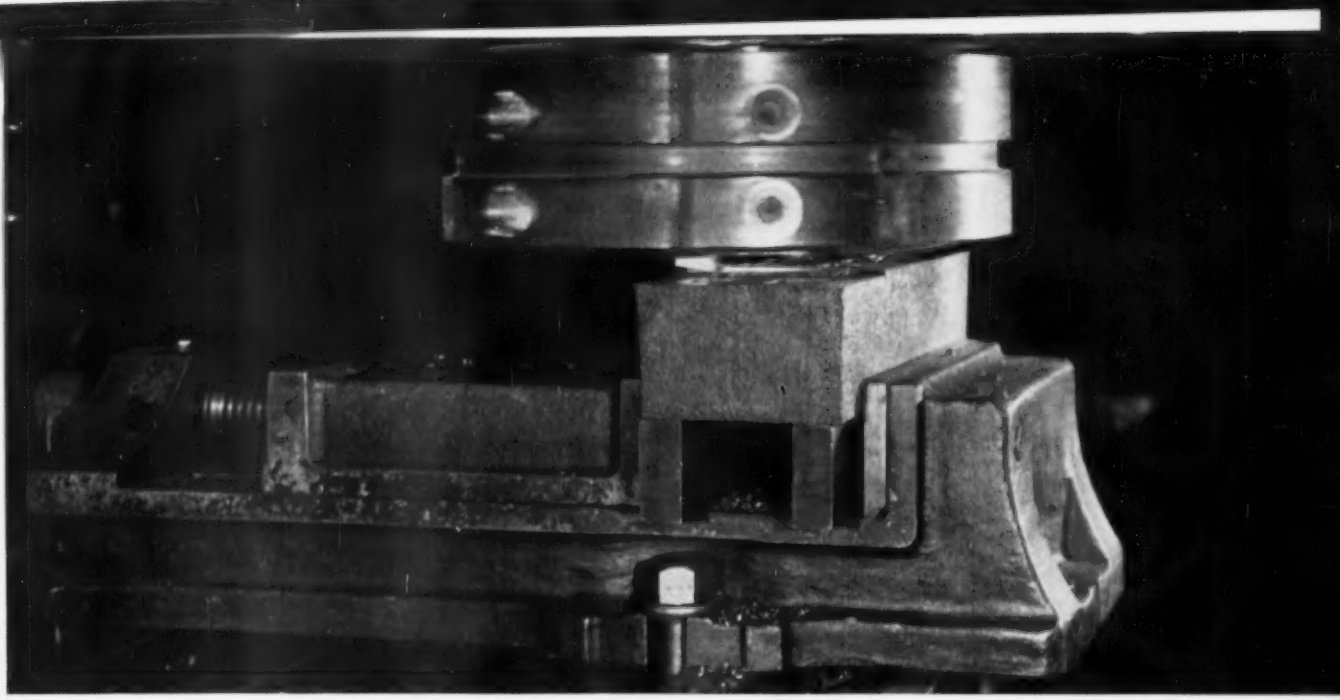
ACCO

AMERICAN CHAIN & CABLE

BRIDGEPORT, CONN.

Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Wilkes-Barre, Pa., York, Pa.
In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

Better Value



Grade 860 – .012" wear, no chipping

Grade "A" – .035" wear, some chipping

Grade "B" – .025" chipped

Wear land comparison tests prove Grade 860 provides greater resistance to chipping, cratering. After milling 72¾ lineal inches on a cast-iron block with interrupted cuts to simulate cylinder blocks, wear on Grade 860 is minute. Two typical carbides tested under identical conditions show extensive chipping. **Speed** – 377 fpm. **Feed** – .0096". **Table travel** – 1¼ ipm. **Depth of cut** – .100".

On high-tensile gray cast irons . . .

TOUGH, NEW CARBOLOY MILLING GRADE 860 GREATLY REDUCES CHIPPING AND CRATERING

Carboloy® Milling Grade 860 was specially developed to provide longer tool life on the harder, denser types of gray cast iron now coming into common use.

Stronger cutting edges make Grade 860 far more resistant to chipping and cratering than any other available carbide. Tougher internal structure provides longer tool life and more production per grind.

Improves production 20-30%

Carboloy Grade 860 has been tested for almost a year on high-tensile cast irons ranging from 223 to 248 Brinell hardness. Despite scale and interruptions, this new carbide has consistently outperformed ordinary grades by 20-30%.

At speeds ranging from 250 to 300 fpm, Grade 860 produces excellent finishes. It is especially efficient for face milling operations, and can also be used to advantage for plain milling.

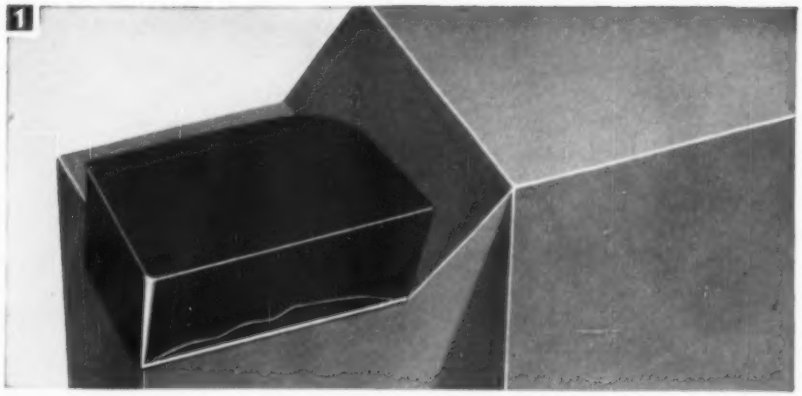
Specify new Carboloy Grade 860 for your milling cutters. For more details or technical information, write today . . . or mail the coupon on page 4 of this advertisement.

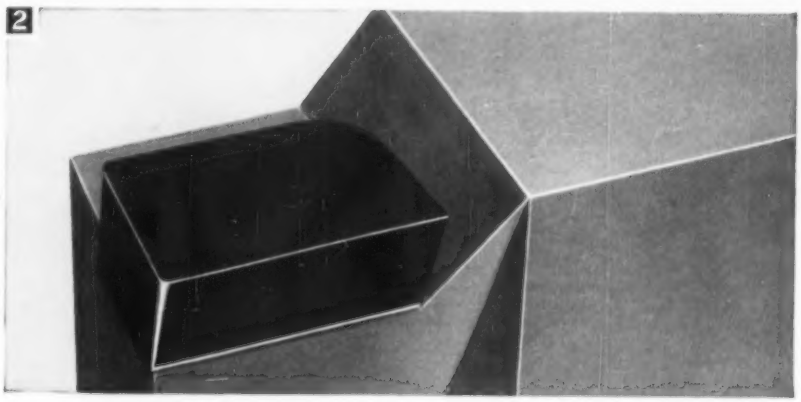
CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

BRAZING CRACKS ELIMINATED

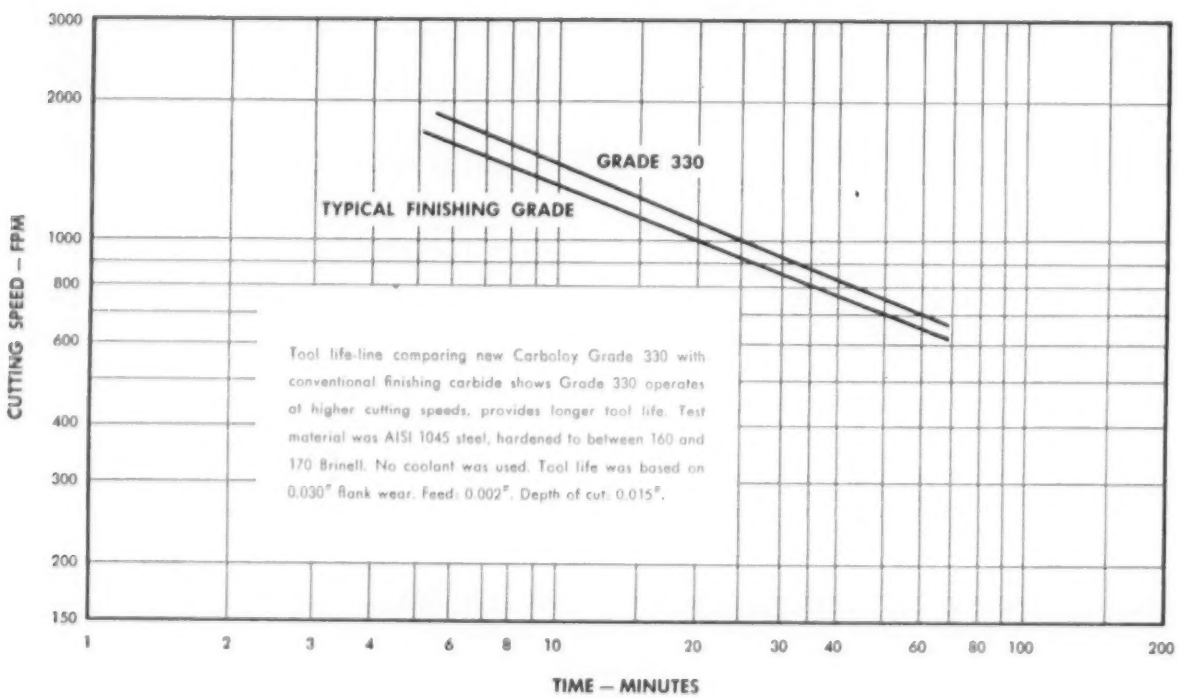
Conventional carbide (Figure 1) shows type of brazing crack that can greatly reduce tool life and increase machining costs.

Carboloy Grade 330 (Figure 2) uses nickel binder to provide greater strength and toughness to resist brazing strains. For further protection, the wholly new composition of Grade 330 permits the use of high-silver solders with lower melting points. (Photos have been retouched to bring out brazing cracks difficult to see with the naked eye.)

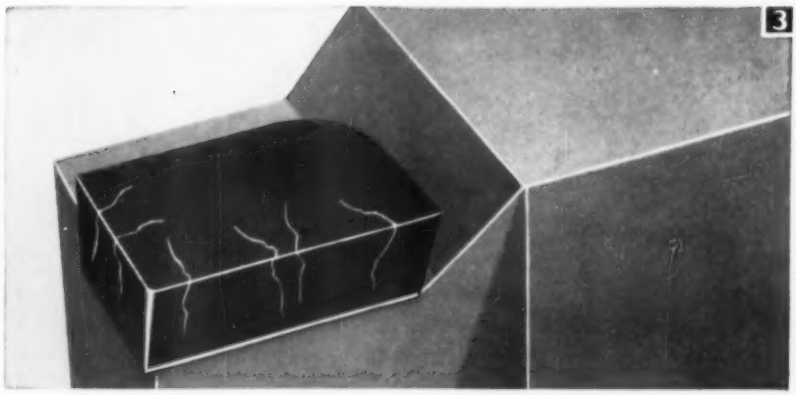


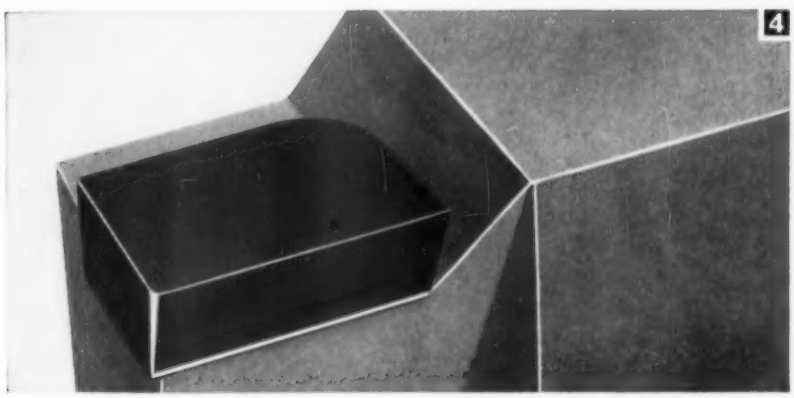


NEW CARBOLOY STEEL-FINISHING GRADE 330



Tool life-line comparing new Carboloy Grade 330 with conventional finishing carbide shows Grade 330 operates at higher cutting speeds, provides longer tool life. Test material was AISI 1045 steel, hardened to between 160 and 170 Brinell. No coolant was used. Tool life was based on 0.030" flank wear. Feed: 0.002". Depth of cut: 0.015".





GRINDING CRACKS ELIMINATED

Ordinary steel-finishing carbides are so brittle that grinding cracks (Figure 3) frequently appear. Automatic grinders cannot normally be used.

Because Grade 330 (Figure 4) has twice the transverse rupture strength of ordinary carbides, it has superior resistance to grinding cracks, can be easily ground on duplicating-type grinders. (Photos have been retouched to bring out grinding cracks difficult to see with the naked eye.)

MACHINES FASTER, WEARS 20-35% LONGER

- **Easier to braze and grind**
- **Double transverse rupture strength**
- **More resistant to chipping, cracking**

With a transverse rupture strength of 200,000 psi, new Carboloy Finishing Grade 330 is nearly twice as strong as conventional steel-finishing carbides.

Used on finishing and boring jobs, this extra strength means greater resistance to chipping and cracking, along with improved tool life.

Entirely new composition

The secret of Grade 330 is its higher titanium-carbide content and nickel binder. Grade 330 is tougher, easier to grind, and more wear resistant than cobalt-binder grades.

Production tests on AISI 1045 steel (see chart at left) show Grade 330 can be operated at speeds 10% higher than other carbides without any loss in tool life. When compared at speeds ranging from 600 to 1900 fpm, Grade 330 consistently provided 20-35% longer tool life than other grades.

Extra-performance steel-cutting carbides

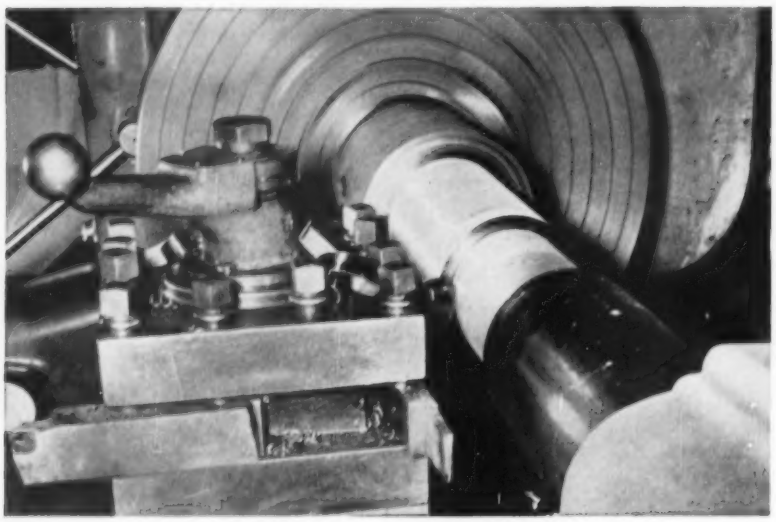
Grade 330 rounds out the Carboloy extra-performance Series 300 carbides (Grades 350, 370), taking up on finishing and boring where Grade 350 leaves off.

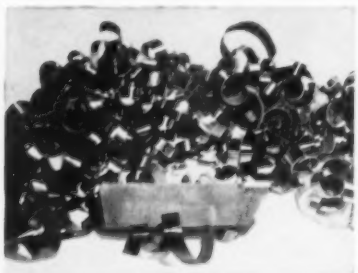
Throw-away inserts, standard blanks, square and solid boring tools are now available from Authorized Carboloy Distributors. For price list and specifications on Grade 330, send the coupon on page 4 of this advertisement.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

GET MORE OUTPUT FROM YOUR MACHINES WITH CARBOLOY GRADES 350 AND 370

▶ **Remove more steel per minute** ▶ **Reduce downtime and tool costs**





Eighteen pounds of steel (above) are removed per minute by Grade 370 tool at Improved Machinery Inc., Nashua, N.H. Grade 370 roughs and finishes rolls at twice the speeds of previous carbides, lasts twice as long, saves 14 hours per day in labor.

SETUP: Material—Combination of mild and stainless steel. **Speed**—500-800 fpm. **Feed**—0.021" for roughing; 0.016" for finishing. **Depth of cut**—⅝"-¾". **Coolant**—No.

Carboloy Grades 350 and 370 are *extra-performance* carbides. They are specifically designed to take heavier, deeper cuts at faster speeds . . . to provide maximum machine output at lowest tool cost.

Hundreds of in-plant case histories like the one above have proved Grades 350 and 370 consistently outperform, outwear all other steel-cutting carbides.

Greatly increase output

Even on the toughest jobs, these carbides have brought production increases ranging from 30% to 300% . . . reducing the cost per finished piece.

Carboloy Grades 350 and 370 have a built-in structural rigidity that resists edge deformation even at temperatures as high as 1800° F. Their ability to stay on the job longer means less downtime, more production from the machine.

Complete stocks available locally

Try medium-duty Grade 350 and heavy-duty Grade 370 on your steel-cutting jobs . . . and lower your tooling costs.

Your local Authorized Carboloy Distributor maintains complete stocks of both these grades in a wide range of tools, blanks, and inserts. His name is listed in the Yellow Pages of the phone book. For more information, call him today or mail the coupon below.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11149 E. 8 Mile Road, Detroit 32, Michigan

Send me more information on:

- ☐ New Milling Grade 860
- ☐ New Finishing Grade 330
- ☐ Grades 350 and 370
- ☐ Send the name of the nearest Authorized Carboloy Distributor

Name_____

Title_____

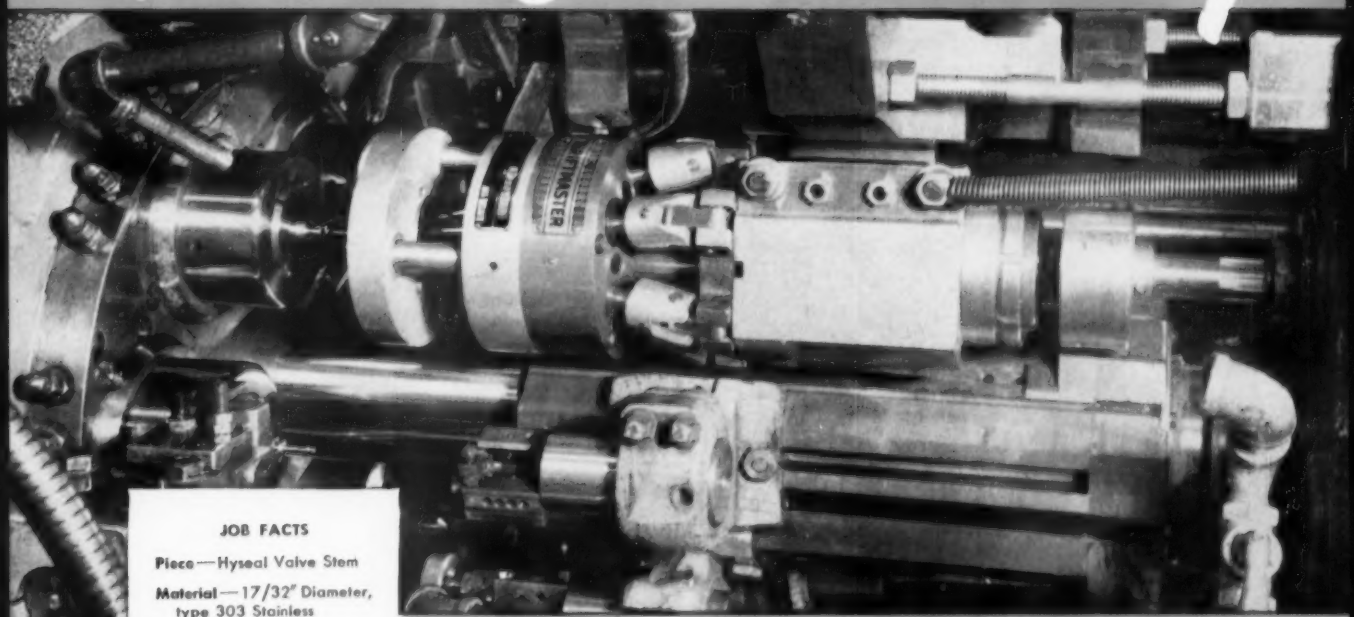
Company_____

Address_____

City_____ Zone____ State_____

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

with Acme-Gridley



JOB FACTS

Piece—Hyseal Valve Stem

Material—17/32" Diameter, type 303 Stainless

Operations—10, including multiple end milling of six half-holes at a 15° angle

Machine Time—12 seconds

Machine—1-1/4" RA-6 Acme-Gridley Bar Automatic

Schaible Single-Lever Kitchen Mixing Faucet lets you select both the temperature and amount of water you need with one simple motion—the boon to modern living.

you get CLOSER TOLERANCES with more operations in a single setup

Following exhaustive study of other methods, the Schaible Company found that the only method of producing this valve stem to their rigid specifications at a reasonable cost was on a six-spindle Acme-Gridley bar automatic. Ten operations (including multiple end milling of six half-holes on a 15° angle) were performed in a single setup in 12 seconds machine time. Specifications required a 20 microinch finish to avoid wear on nonferrous components and working to limits of .002" t. i. r. between seating surface and end of valve stem.

BULLETIN TP-44 *shows tooling setups on 44 different bar jobs. Write today for your free copy and learn how both greater accuracy and reduced costs can be yours on an Acme-Gridley.*

National Acme

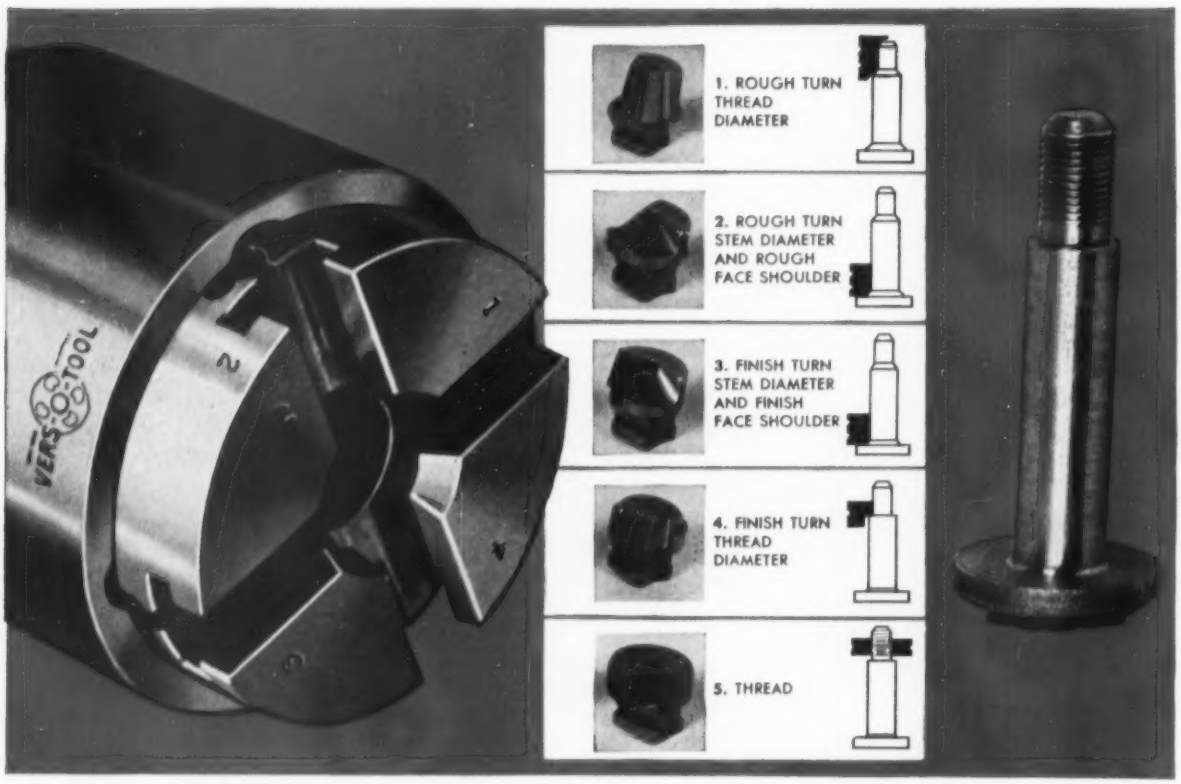
THE NATIONAL ACME COMPANY • 171 EAST 131ST STREET • CLEVELAND 8, OHIO

The Namco VERS-O-TOOL is the world's most versatile threading and hollow milling head . . . read about it on the next page → → →

HERE'S HOW NAMCO VERS-O-TOOL

CUTS COSTS... SPEEDS PRODUCTION ON END TURNING AND FORMING

In this application 300 lever supports an hour are turned out on a vertical six-spindle automatic. Vers-O-Tool machines these steel forgings three times faster than single point tools, opens at the end of the cut, leaves no spiral marks on the work.


VERS-O-TOOL
1. ROUGH TURN THREAD DIAMETER
2. ROUGH TURN STEM DIAMETER AND ROUGH FACE SHOULDER
3. FINISH TURN STEM DIAMETER AND FINISH FACE SHOULDER
4. FINISH TURN THREAD DIAMETER
5. THREAD

Vers-O-Tool licks tough production problems because:

1 Basic Vers-O-Tool design permits cutters or ground thread chasers to be changed quickly without adjustment in the head.

2 All settings in the blocks are made in the tool-room with a micrometer gauge—no need for trial and error run after changing or grinding.

SEND FOR THIS CATALOG DT-52

the National Acme company

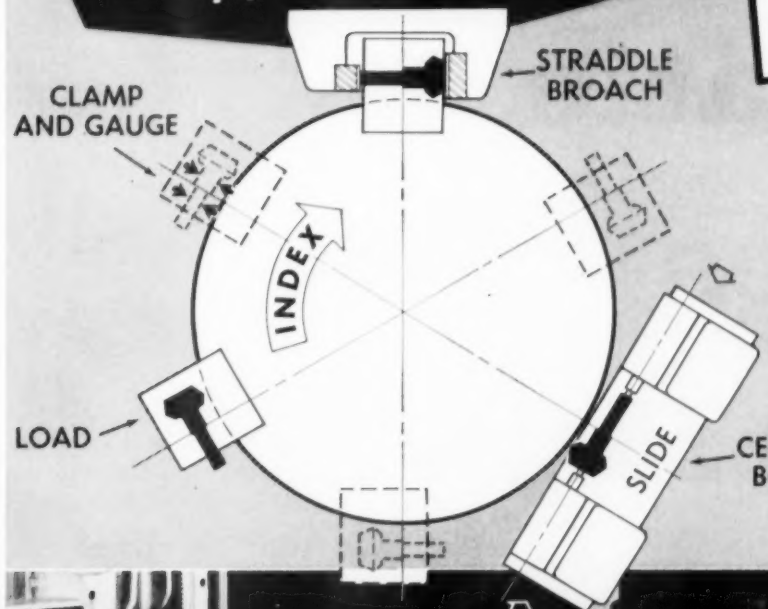
171 EAST 131ST STREET • CLEVELAND 8, OHIO

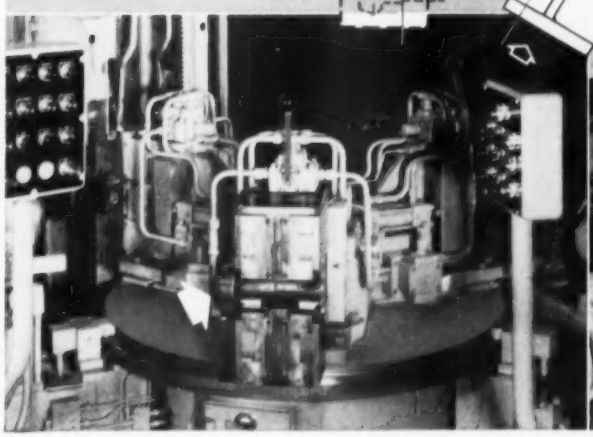
←←← WANT CLOSER TOLERANCES?... See (on preceding page) how ACME-GRIDLEY Tooling Experience solved critical tolerance problem

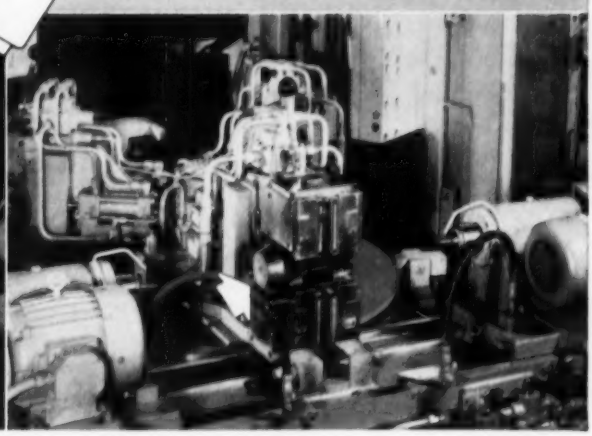
ANOTHER *American* FIRST

DIAL-INDEX, BROACH AND CENTER MACHINE FINISHES 2 ENDS OF PINION

. . . 170 parts per hour







Automative pinion forgings are loaded at this, the first of six stations on a dial-type indexing unit. At the next station, part is automatically clamped and gauged — oversize parts stop the cycle. At the third station, both ends of pinion are straddle broached.

While one part is being broached, both ends of another part are being center drilled at the station shown here. Broaching, drilling and dial indexing are interlocked and completely automatic. Operator has time to unload and reload fixtures as they index to him.

Write or 'phone details of your broaching requirements. Or write for Catalog 450.

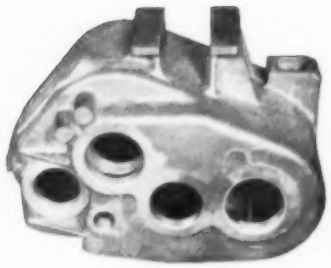
AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

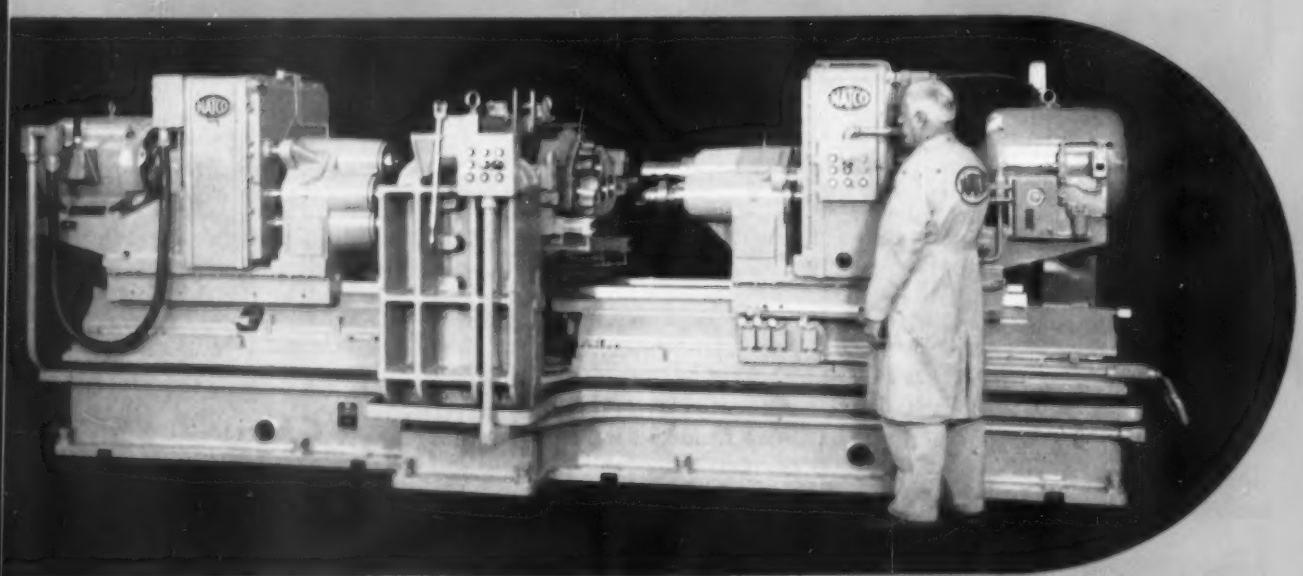
SUNDSTRAND

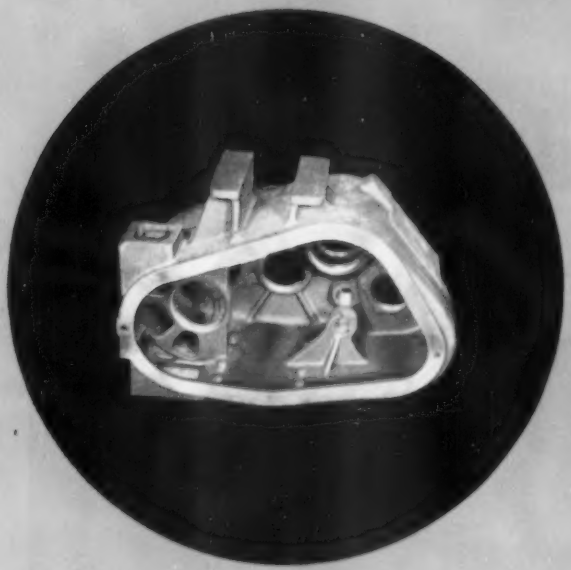
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



Natco® Automatic Matches Boring Mill Accuracy

and quickly converts for five different jobs





This Natco two-way machine stepped in where automatics "fear to tread!" It replaced a precision boring mill, speeded production and didn't give up a tenth in accuracy! At The Frank G. Hough Co. boring mills were used for exacting tolerances on transmission parts for the Hough Payloader®. Higher production was desired.

Now with a Natco two-way automatic, Hough is getting production rates—not job shop rates. The Natco bores diameters to within .0005"—square with mounting face within .0005" per inch bore length. The machine also chamfers, counterbores and notches boss contours.

Versatile too! Hough processes five different transmission housings or covers with a single machine. After a typical production run averaging 100 parts, the machine is quickly converted to another job.

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

National Automatic Tool Company, Inc. *Richmond, Indiana*

Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production.

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

NATCO

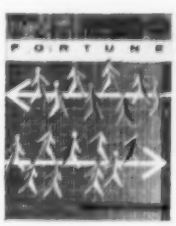
Notes from Natco...

Middle Age Spread

Having reached the age of 55 feeling as spry as the day we started, we at Natco are going to spread out. The demand for our products makes this necessary since we're anxious to give our customers the kind of deliveries they need.

After Jan. 1, 1957, when the job is finished, we'll have eight acres under one roof at our Richmond, Indiana plant. We figure it will increase our production capacity about 50%.

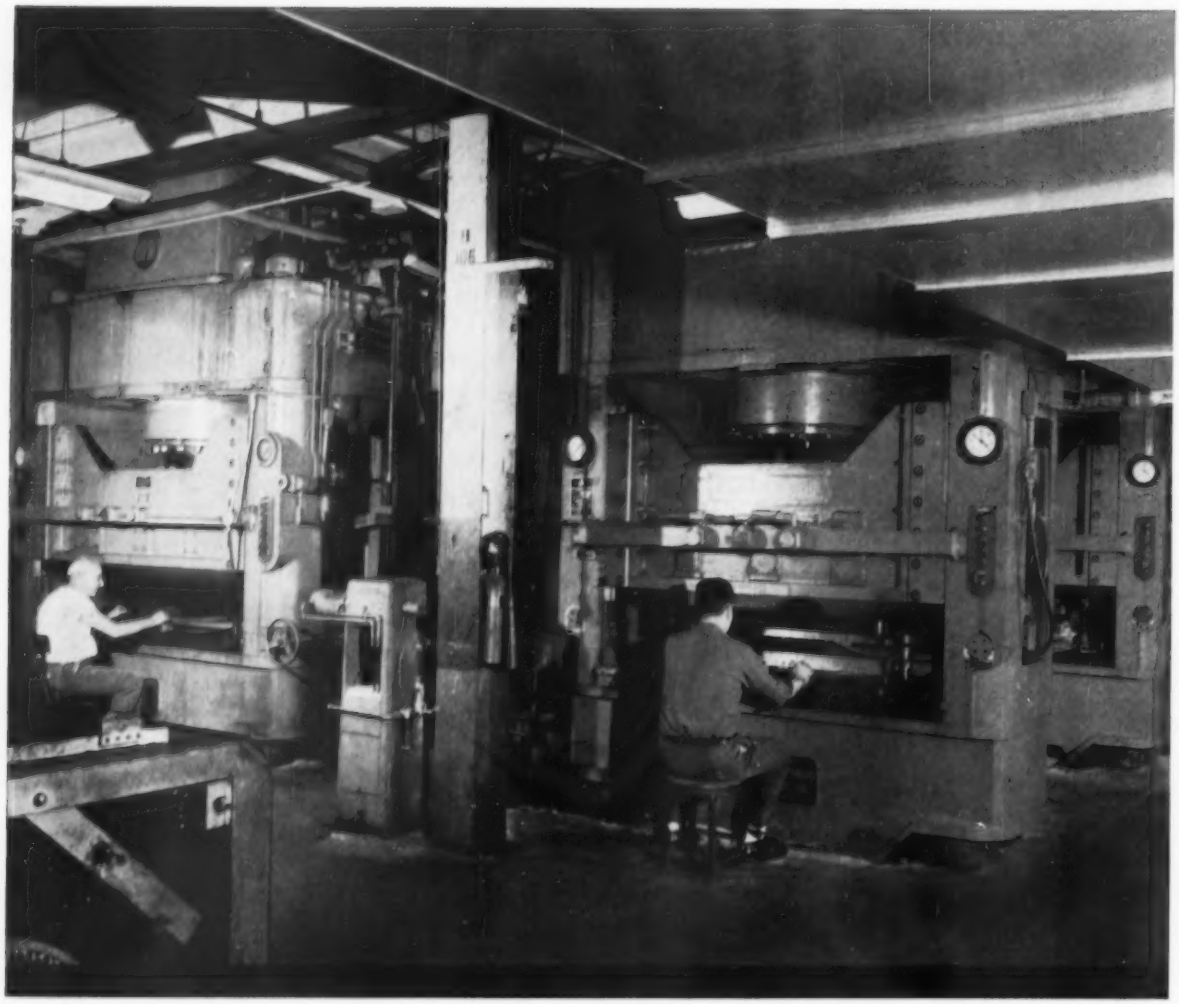
To take care of the increased need for Sales Service, we've already increased our staff about 50% and provided them with new efficient quarters.



Appreciating Depreciation

Depreciation, we've come to realize, is one of the least understood and most important aspects of the business picture today. Though we're far from experts on the ins and outs of this complex subject, we've undertaken to discuss the importance of looking at depreciation realistically in our current FORTUNE campaign. We'll be happy to send you reprints if you'll drop us a line.

TO BE SURE IT'S H-P-M



Material flows through this press department smoothly and efficiently. Special frames on these short stroke H-P-Ms permit use of presses in areas with low ceiling limits. H-P-M fits the equipment to the job without sacrificing normal press efficiency.

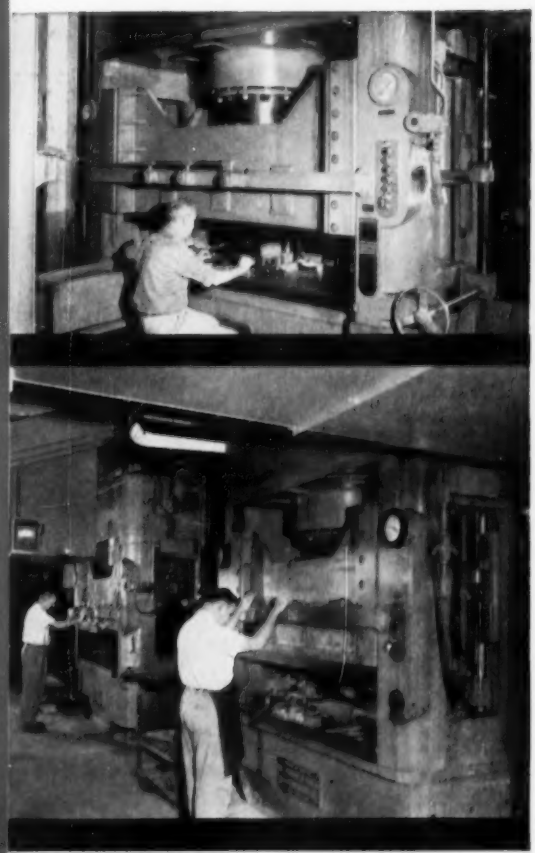
distributors in other cities.

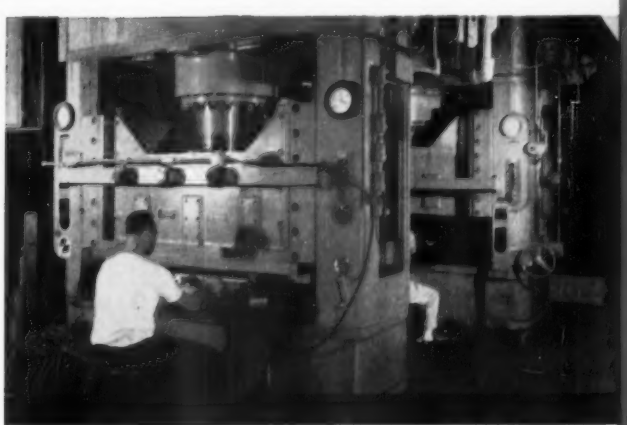
drop us a line.

AT Westinghouse

■ The effective utilization of important floor space in today's busy plants calls for maximum production per square foot. At the Westinghouse Electric Corporation in Mansfield, Ohio, waste motion and waste floor space are eliminated wherever possible. Seven H-P-Ms, from 200 to 600 ton capacities, are fitted into a compact press room facility. Metal forming operations are concentrated in minimum space for greatest economy of operation and material handling.

H-P-M All-Hydraulic presses are versatile . . . adapt easily to modern metal forming jobs. H-P-M's exclusive closed-circuit FASTRAVERSE system of press operation is infinitely adjustable, permitting the press to be easily and quickly regulated for each specific application. Accurate control of drawing speed, plus total elimination of high impact stresses, guarantees proper metal flow. Independent control of each hydraulic action provides just the right tonnage for each job. H-P-Ms have become basic press room equipment for hundreds of industries both here and abroad. There's a reason . . . may we send you complete information?





What could you do with six H-P-Ms in a compact area like this? Let H-P-M engineers plan your complete press facility—show you how to be SURE with money-making H-P-Ms.

METAL WORKING DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

HPM

TAPS *by* Card

The CARD Quality

When you specify Taps or Gages *by Card*, you know you're getting the finest. Card's long experience in the manufacture of precision tools is your guarantee of satisfaction. In every industry the superior performance of Card taps and gages is speeding production, helping to turn out better products faster.

Presenting the Symbol of Service

YOUR CARD DISTRIBUTOR

S. W. CARD MANUFACTURING CO., Mansfield, Massachusetts
Division of UNION TWIST DRILL COMPANY

GAGES *by* Card

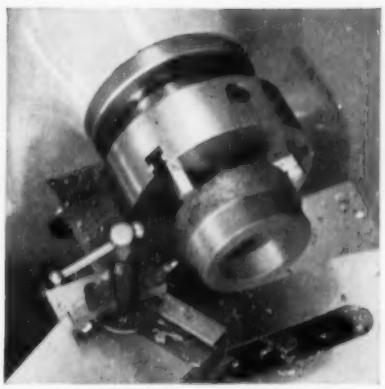
TAPS · DIES · SCREW PLATES · GAGES

HARDINGE
ELMIRA, N.Y.

"The Outstanding Tool Room Lathe"

Precision Collet work for all sizes to 1-1/16 Collet seats *directly* in spindle.

Precision Step Chucks for diameters up to 6". Provides Collet-like accuracy.



Integral Mount Jaw Chucks for precision holding of regular or irregular shapes up to 5".

Hardinge Model HLV 10" Lathe was primarily designed to fill a very old existent gap between the plain precision bench lathe and the heavy duty engine lathe.
Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and ease of operation to obtain the desired results rapidly.

Write for Bulletin HLV

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

Offices In Principal Cities. Export Office: 269 Lafayette St., N.Y. 12, N.Y.

SHEFFIELD

Adjustable AIR GAGE TOOLING for Short Runs and Emergencies

SUCH AS:

- **Aircraft manufacturers, subcontractors and job shops having limited production.**
- **Accidental damage to a vitally needed single purpose gage.**
- **An unexpected engineering change involving part size.**
- **A short run of special parts for which no gages have been provided.**
- **A mistake or failure in ordering the needed single purpose gages.**
- **Sudden need for process gages at the production machines.**

Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the tooling here illustrated is your best insurance against unpredictable production losses.

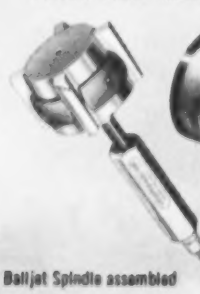
Write Dept. 1 for descriptive engineering data. *THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.*

Economical, Adjustable Balljet Spindle Kit

In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1" to 3" in diameter.

Consider economy for a moment. If the holes you may encounter vary in increments of .001", this Kit provides the equivalent of 2000 Spindles at a unit cost of less than a dollar. If those increments are .0001" you have available 20,000 Spindles at about a dime each. That is real economy.

No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.


Balljet Spindle assembled

Balljet Spindle in use

Calibrating Fixture

Adjustable Balljet Spindle Kit

Adjustable Airebore Gage

Adjustable Airebore Gage

Airebore Gage in use

Airebore Gage assembled

The Airebore Gage can be set precisely to measure any diameter hole from 3″ to 12″. And like the Adjustable Balljet Spindle, it is set up with a calibrator and gage blocks. No master setting rings are needed.

The Airebore Gage is self-centering—needs only to be rocked in place for precision action. It is light in weight with all contact surfaces of tungsten carbide—nothing to wear out.

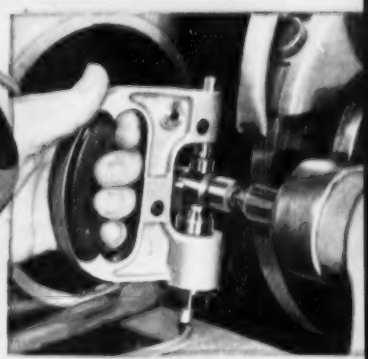
Three-Point Adjustable Spindles

Three Point Adjustable Spindles

The Three-Point Adjustable Spindles, four of them, cover respectively the ranges, ⅜″ to 9/16″, 9/16″ to 1″, ⅞″ to 1½″ and 1½″ to 3″. They can be set up with gage blocks.

Plunjet Indicator Snap Gage

Plunjet Snap Gage

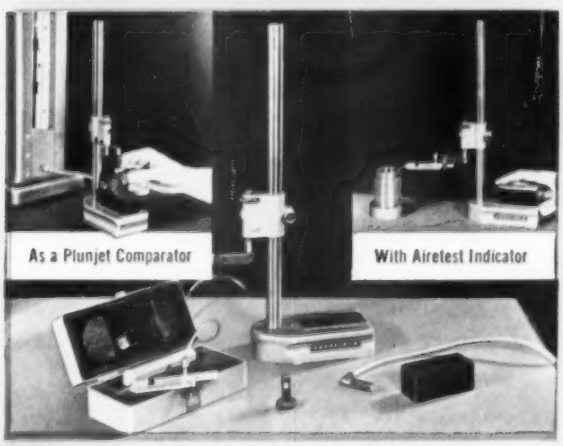


Plunjet Snap Gage in use

The Plunjet Gaging Cartridge may be substituted for the Dial Indicator to assure consistent, repetitive readings, especially when tolerances are .001″ or less.

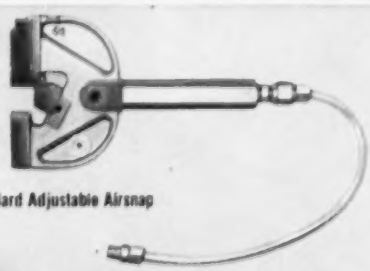
Twelve Plunjet Snap Gage models cover the gaging range of 0″ to 12″. Larger sizes are available on special order.

Airetest and Plunjet Stand



A new, highly versatile stand accommodates a dial indicator or an Airetest Indicator—also converts to a comparator by using a Plunjet and anvil as illustrated.

Standard Adjustable Airsnaps



Standard Adjustable Airsnap

The Standard Adjustable Airsnap in 17 models covers the range .2500″ to 5.500″. Up to 3.000″ the adjustable anvil has a maximum adjustment of ¼″. Above that the maximum is ½″.

GOLDEN ANNIVERSARY

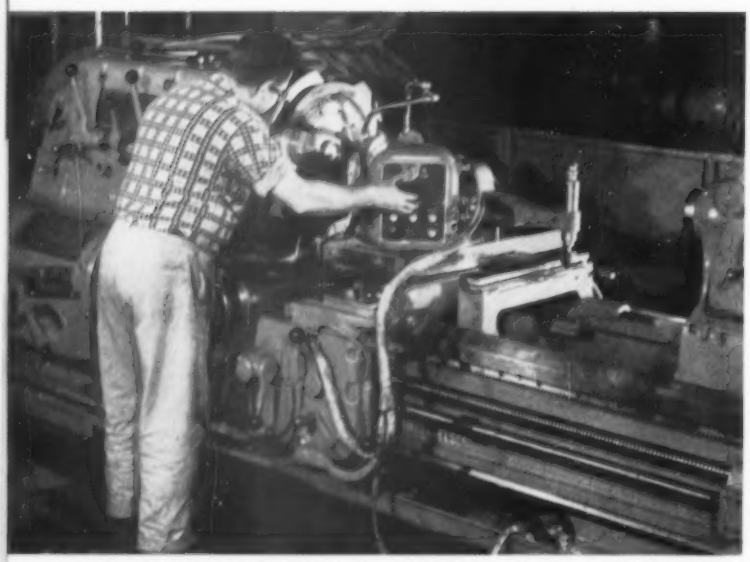
SHEFFIELD

manufacture and measurement for mankind

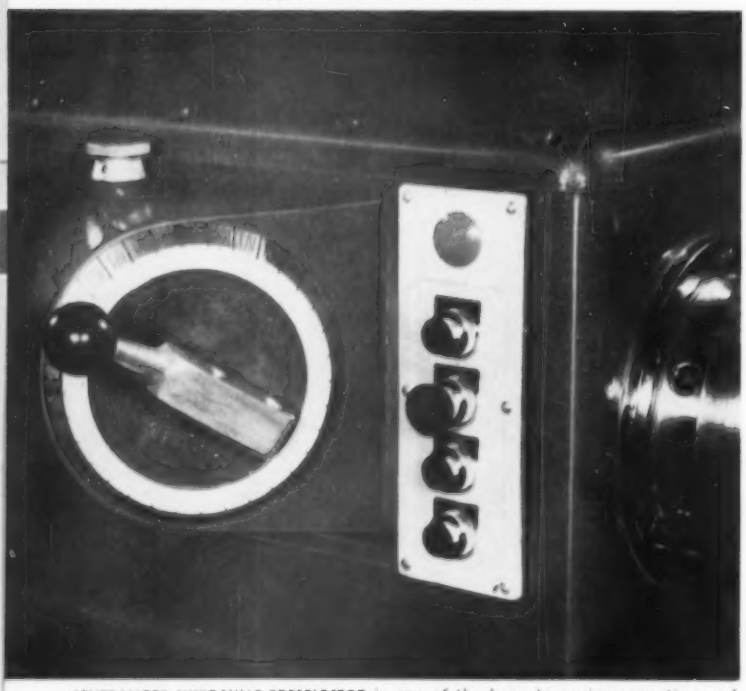
7220

AXELSON production

AXELSON MANUFACTURING COMPANY



TURBO-JET ENGINE PRODUCTION. Contouring aft side of 125-pound turbine wheel on Axelson lathe equipped with electronic duplicator.



CENTRALIZED HYDRAULIC PRESELECTOR is one of the keys to easier operation and unusual flexibility of the Axelson 2516 heavy-duty lathe. With the preselector, the lathe can be used with equal ease for long-run production or single set-up operations.

ELECTRONIC TRACER CONTROL FEATURED IN JET TURBINE PRODUCTION

Rotating engine parts, which operate under widely fluctuating environmental conditions during high-speed aircraft flight, must be precisely machined so expansion and contraction of the metal will not affect engine performance.

At General Electric's AGT Division, Evendale, Ohio, Axelson lathes equipped with electronic duplicators reproduce turbo-jet engine parts. Using simple, flat templates, the electronic duplicators precisely control the lathes for highly-accurate contour-facing operations. Special carbide-tipped tools are used in the two-stage turning operations on the 28-32 Rockwell, Timken steel turbine rotor wheels. Floor-to-floor time for these two operations is less than an average work day.

NEW 2516 HEAVY-DUTY LATHE SIMPLIFIES OPERATOR CONTROL

Speed selection of 32 different spindle speeds from 11 to 1600 RPM has been greatly simplified in the new Axelson 2516 heavy-duty lathe through the use of a hydraulic preselector.

The operator can preset a new spindle speed while the lathe is in operation, move to the end of the bed and, without returning to the headstock, automatically switch to the preselected speed by operating a lever on the apron.

Speed changes are made through involute clutches; the headstock contains no sliding gears.

For a complete description and detailed specifications on the 2516, the new Axelson 4025 and Axelson Tool Room, Medium-Duty and other Heavy-Duty Lathes, write for bulletins A7-5507 and 5504.

AXELSON

AXELSON MANUFACTURING COMPANY
Division of U. S. Industries, Inc.
6160 SOUTH BOYLE AVENUE
LOS ANGELES 58, CALIFORNIA

and maintenance news

DIVISION OF U. S. INDUSTRIES, INC. / 6160 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA

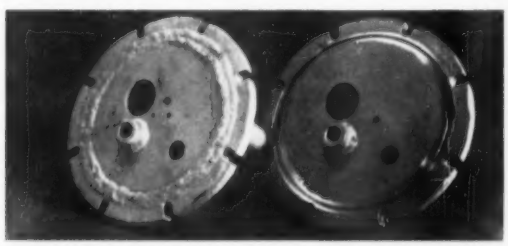
Lathe flexibility opens new fields for job-shop machining

"Ours is primarily a job shop specializing in fittings, special valves and educters. Each job presents a different problem, and in many cases the setups are more time-consuming than actual cutting time. Most of our work is in bronze, monel, stainless steel and hastelloy.

"Before we obtained our Axelsons, we were unable to do the type and class of work we are now doing profitably. We know they've opened up new fields for us.

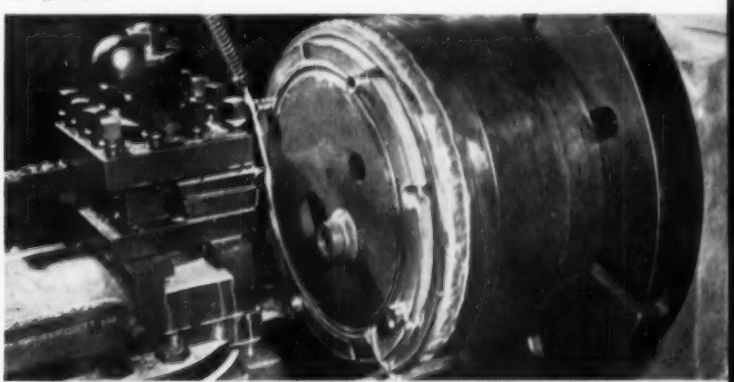
"We're sold 100% on our Axelsons because they're accurate, rigid and require very little maintenance."

Agnew W. Derbyshire Jr., Plant Superintendent
Derbyshire Machine & Tool Co., Philadelphia, Pa.



PRODUCTION PARTS. Tube head before and after machining, shows built-up nickel weld and subsequent grooves.

JOB SHOP MACHINING. Roughing off nickel weld of tube head before cutting the grooves.



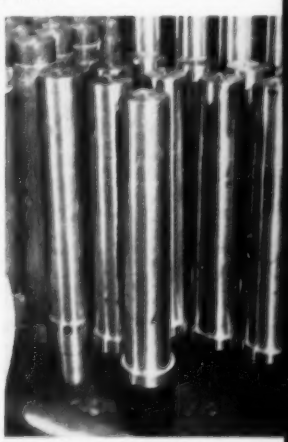
GROOVING. Double nickel weld in tube head is grooved 1/16" deep. Another groove, .046" wide and .046" deep, is cut within the first.

Pipe Mill Machinery Production Calls for Multiple Operations, Work-Horse Performance

Turning, boring, threading, drilling, tracing and die-forming are some of the operations performed by Axelson lathes at Taylor-Wilson Manufacturing Company, McKees Rocks, Pennsylvania.

In one setup, an Axelson 25" engine lathe bores, turns and faces a cast steel collet body. In another, a 20" lathe turns diameters of 55-pound roller shafts for pipe mill cutoff tables. According to August F. Carioto, Taylor-Wilson Plant Manager: "We find ease of operation, speed and accuracy the most important features of our Axelson lathes. Their performance has made Taylor-Wilson's five Axelsons the production and maintenance work-horses in the manufacture of pipe mill machinery."

ROLLER SHAFT PRODUCTION. An Axelson 20" lathe performs final cutting operation on a conveyor roller shaft. Floor-to-floor time for rough and finish cuts is 45 minutes.



PRODUCTION PARTS. Roller shafts of 1045 SAE steel are finish-turned with carbide tools.

the finest high production lathes

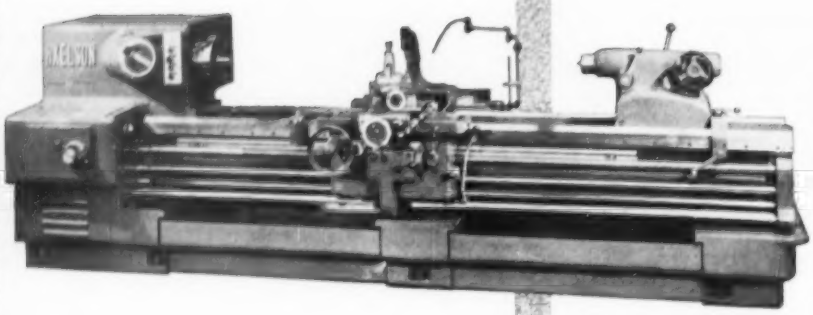
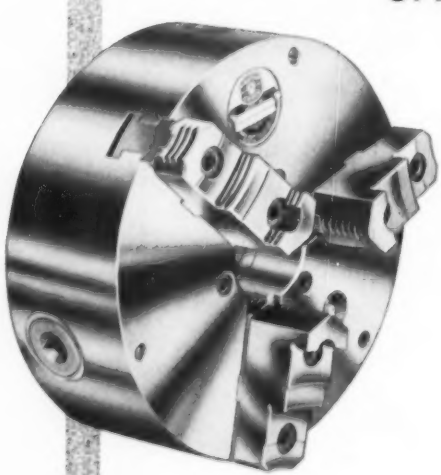


Photo courtesy Axelson Manufacturing Co.

Axelson's new 25/16 heavy-duty engine lathe is designed to increase production, reduce turning time and simplify operator control. It features 40 h.p. over 32 spindle speeds, a single lever hydraulic speed selector, 66 feed combinations, exclusive 5-position diameter cross-feed disconnect stop and 7-position longitudinal power-feed disconnect stop. For more information, write Axelson Manufacturing Co., 6160 South Boyle Ave., Los Angeles 58, California.

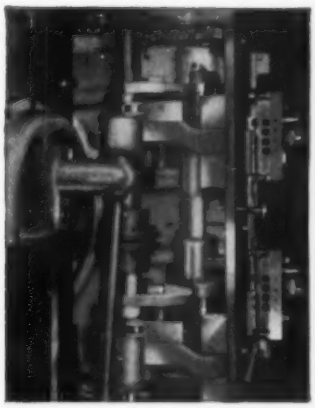
deserve the finest high production chucks

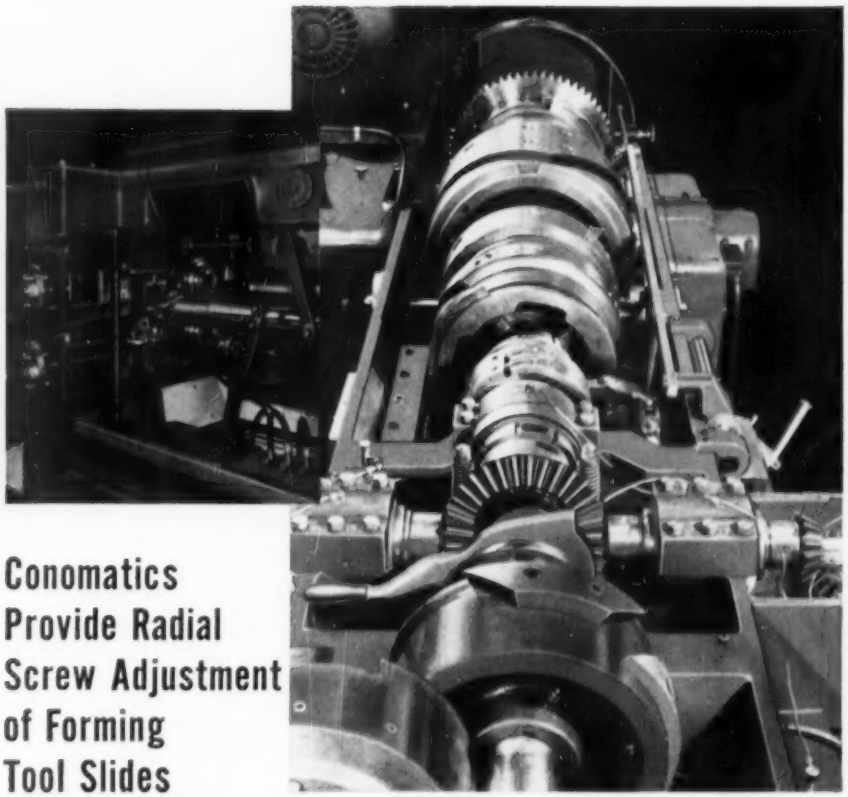
This is Horton's standard 3-Jaw Scroll Universal Chuck which has contributed to Horton's reputation for chuck leadership for over 100 years. Its precision and lasting accuracy make it a must in any production picture. For the complete story on the complete line of Horton Chucks, see the Horton people in your area now.



HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.



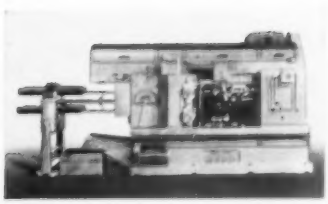


Conomatics Provide Radial Screw Adjustment of Forming Tool Slides

- Models 2⅝" LA, 3½" AD, 5" KL, and 5¼" KR Conomatic Four Spindle Bar Machines are equipped with a number of quick job-change features. One of these is the all-position end attachment drive for the mounting of endworking opposed spindles in all positions, with independent feed to as many as three opposed spindles on a single setup.

  Another feature that is of considerable importance in tooling up is the radial screw adjustment of all sideworking slides. Trial cuts may be taken to correct diameters with form tools without changing the clamped positions of the form tool holders.

  All Conomatic quick changeover models are equipped with dial adjustment of the working stroke of all tool carrying slides. Besides the Four Spindle machines there are three quick change Six Spindle models in 9/16", 1" and 1⅝" sizes.
  Write, wire, or phone for literature.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

1000
~~400~~ sfpm

depth of cut-.125 ~~.005~~

1250
sfpm-~~800~~

"~~un~~machinable"

2000
~~250~~ sfpm

65
pieces per hr.-~~20~~

1175
SAE 1035-~~250~~ sfpm

505
HS-Steel-~~90~~ sfpm

4
min. per cut-~~40~~

you can scrap your ideas of cutting-tool performance . . .

STUPALOX

introduces a NEW ERA!

The figures above show the amazing improvements in production obtained through the use of STUPALOX sintered oxide cutting tools in place of tools previously used. Actually the figures are conservative, because tool performance in many cases was limited by inadequate power and rigidity of the machine tool.

Stupalox Tools are available now in commercial quantities, and a variety of styles and sizes of inserts. Write for complete data.

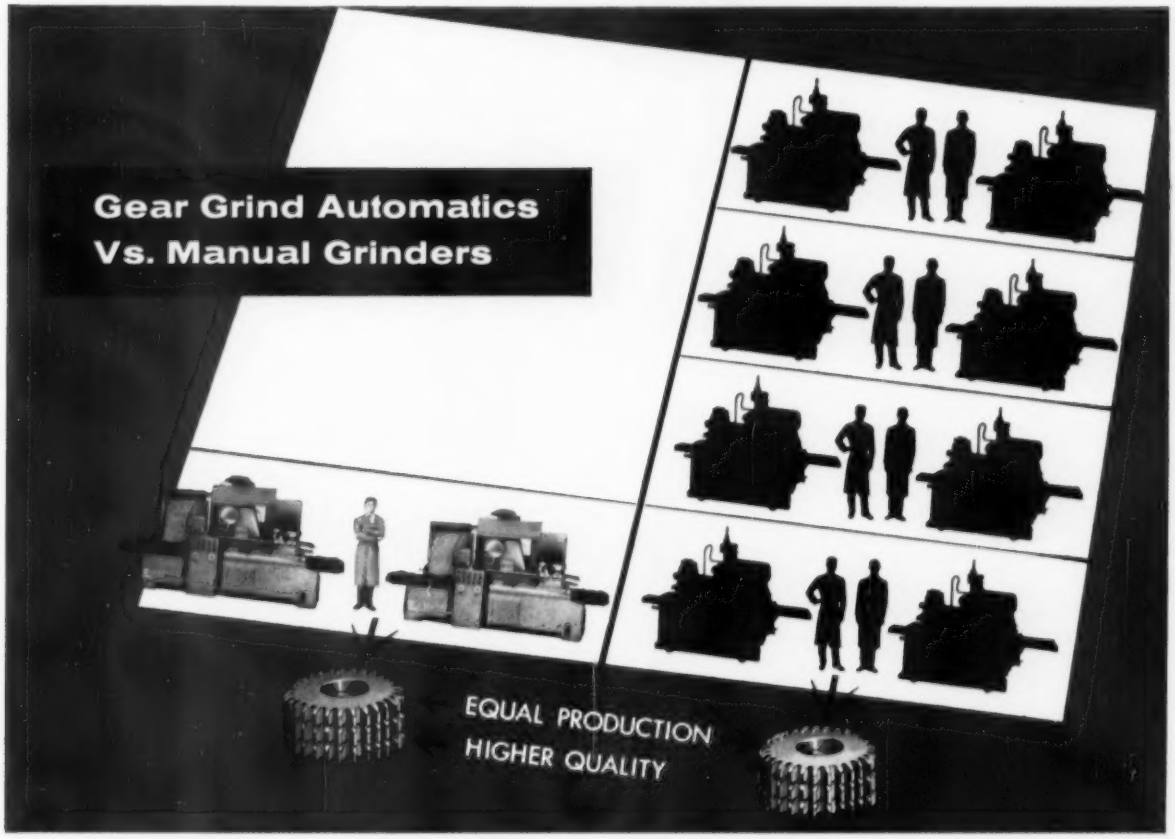
HANDY PACKAGE—*contains ten inserts*

This compact plastic box provides a practical container for ten Stupalox sintered oxide inserts.

Stupakoff
DIVISION OF
The CARBORUNDUM Company

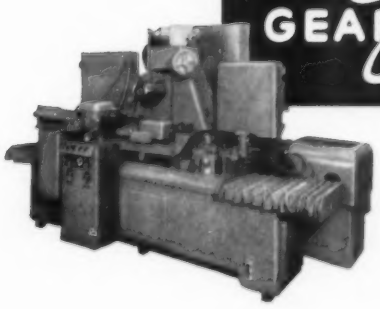
Write Dept. AM
LATROBE,
PENNSYLVANIA

Here's real grinding economy!



2 Automatics with 1 Operator Equals 8 Manuals with 8 Skilled Operators

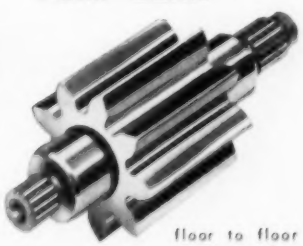
¼ the floor space
¼ the number of machines
⅛ the manpower
} Gear Grinding Economy



GEAR GRIND Detroit

PUMP ROTORS
600 pcs./8 hrs./machine

PUMP GEAR



floor to floor grinding cycle—6 minutes

For all the facts—write today!

THE GEAR GRINDING MACHINE COMPANY

3919 Christopher, Detroit 11, Michigan

Manufacturers of:

The Detroit Screwmatic 750, Automatic Screw Machine.
RZEPPA ("Sheppa") Constant Velocity Universal Joints

The 9' dia. column 3' arm Cincinnati Super Service Radial is working on chassis frame parts and aluminum steering column brackets; ¼" dia. to 1¼" holes drilled and reamed to a .0015" tolerance.

The Upright Drill shown is one of six 28" Super Service Uprights working on heat treated alloy steel frames.

Money-making

Cincinnati Bickford machines

. . . at The Autocar Division, WHITE MOTOR CO. —EXTON, PA.

Photos courtesy the Autocar Division of The White Motor Company, Exton, Pennsylvania.

Speed and easy handling—power and accurate, steady performance were factors in the selection of Cincinnati Bickford Super Service Radial and Upright Drills in this plant. They are quickly adaptable to a variety of operations, including drilling, reaming, tapping and trepanning.

For rapid, accurate, dependable production investigate these cost reducing modern drilling machines.

Write for Bulletin R21C.

CINCINNATI BICKFORD

SUPER C B SERVICE

G&L

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION

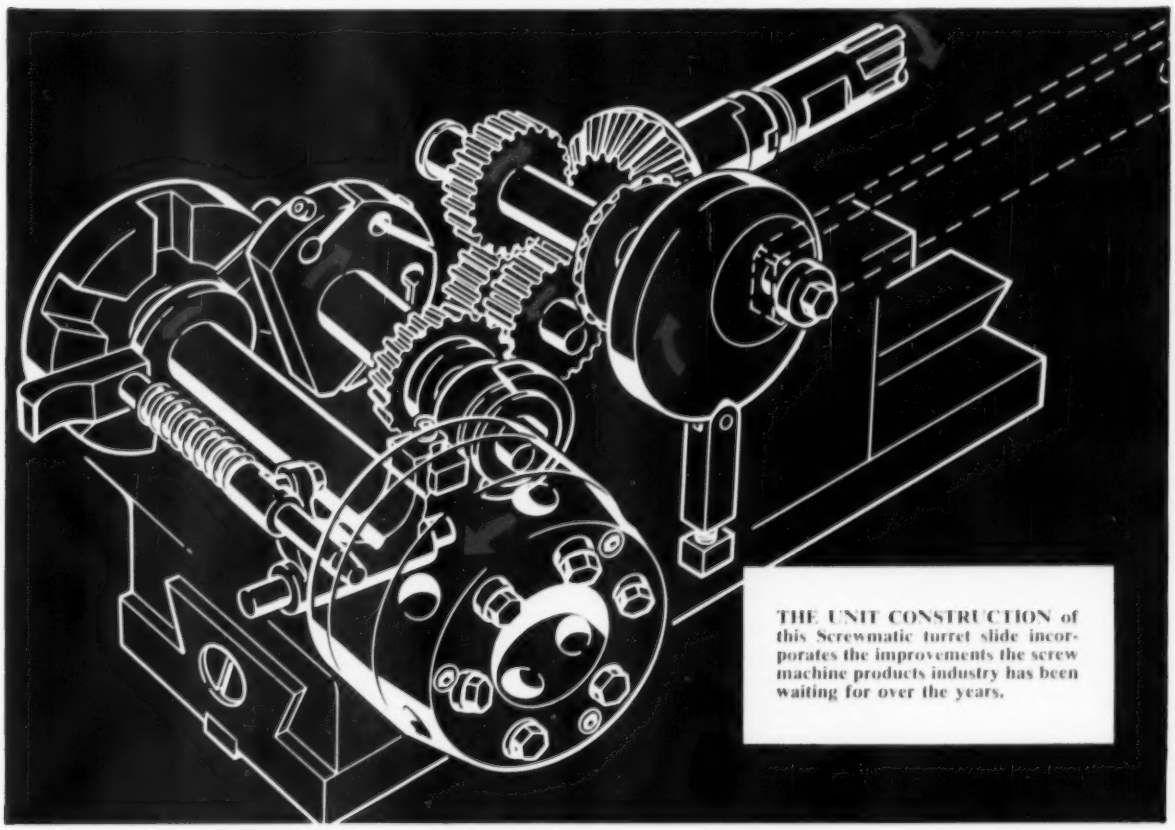
GIDDINGS & LEWIS MACHINE TOOL COMPANY

OAKLEY, CINCINNATI 9, OHIO, U.S.A.

How Much Can This Screwmatic Feature Save You?

PRODUCTION TIME___% MANUFACTURING COST___%

Read These Facts — Fill In The Percentages


THE UNIT CONSTRUCTION of this Screwmatic turret slide incorporates the improvements the screw machine products industry has been waiting for over the years.

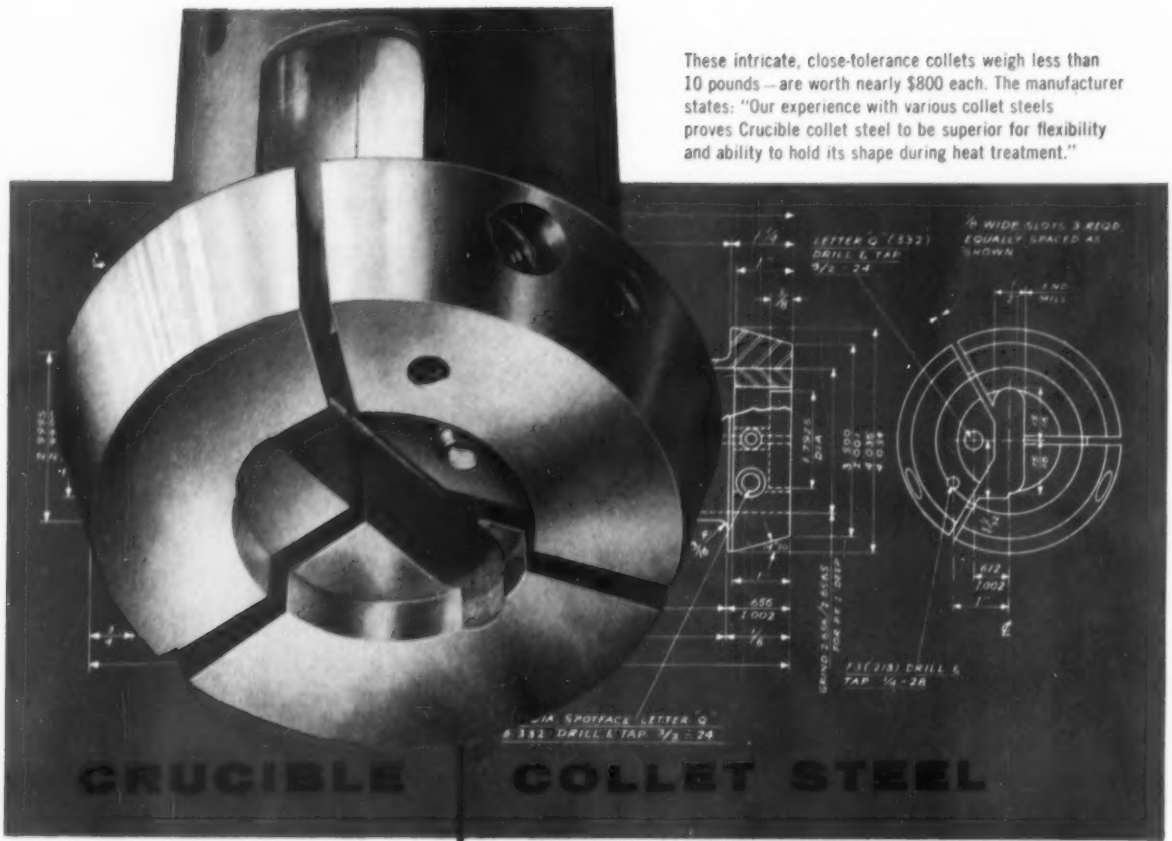
With the new Detroit Screwmatic 750 unit construction turret slide assembly, the facts are simply these:

- positive on-center location of crank disc
- automatic lubrication of moving parts, slide ways
- Geneva motion for smooth indexing also provides means for single or double indexing
- easy change for three different strokes, ⅞, 1½, 2¼ — with full stroke through complete 2¼ movement of lead cam
- turret shaft rotates in precision needle bearings
- slide mounts on replaceable dovetail ways
- turret shaft off-set at 10° for better tool clearance
- removable turret head for quick job changes
- no more rebushing turret to regain alignment
- accurate indexing of turret maintained by tapered lock pin acting in hardened, easily replaceable bushings

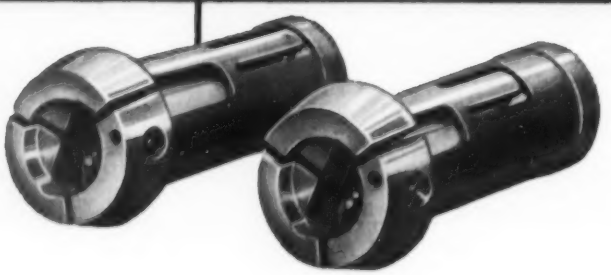
The result: better initial production rates, lower maintenance costs and longer life.

Like to learn more about the cost-saving, new Screwmatic 750? Send for your free copy — today.

A product of **THE GEAR GRINDING MACHINE CO.**
3919 Christopher • Detroit 11, Michigan
Manufacturers of: Fully Automatic Gear Grinding Machines — Rzeppa (Sheppa) Constant Velocity Universal Joints



These intricate, close-tolerance collets weigh less than 10 pounds—are worth nearly $800 each. The manufacturer states: "Our experience with various collet steels proves Crucible collet steel to be superior for flexibility and ability to hold its shape during heat treatment."



for minimum distortion after heat treatment

These collets are used in machining the anchoring end of jet engine turbine blades, while locating the part from reference points on the airfoil section of the blade. It's a job that demands a steel which will not distort during heat treatment. The collet head is heated to Rockwell 58-60 C—the body tempered to 35-38 C.

The steel used is a special Crucible non-warping alloy collet grade. The collet manufacturer, Balas Collet Mfg. Co., Cleveland, Ohio, reports: *The extreme accuracy built into these collets while they are still in the soft state shows less than .0005" distortion on any dimension after heat treatment.*

Crucible collet steel was developed specifically for spring collets—or *any* parts with rigid requirements of excellent machinability and high attainable hardness. Other properties—in almost limitless combination—can be had in other Crucible alloy grades. To see what information is available on these alloy steels—or *any* Crucible special steel—get your copy of the *Crucible Publication Catalog*. Write *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

pneumatic feed—for speed ...on the SEMI-AUTOMATIC

Nichols Miller

In selecting the Nichols Miller with pneumatic table feed, you obtain precision and a high-production semi-automatic machine. The push-button controlled power feed is entirely automatic — leaves the operator free to merely load and unload the work. Often he may run two or three millers with ease. The air cylinder works against the cutter *and* the hydraulic cylinder — completely eliminating chatter and table jump. The unit provides rapid advance from loading position to the cutter, infinitely variable cutting feed, and rapid return to loading position. Also available with power vertical feed to spindle head. If you want high production to "tenths", investigate the Nichols Semi-automatic!

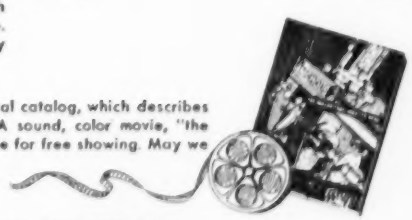
"the miller that uses its head!"

CONDENSED SPECIFICATIONS

Table Working Surface	6¼" x 21"
Longitudinal Travel	
Pneumatic--	9"
Cutting Stroke	5¼"
Hand Screw (Optional)	10"
Transverse Travel	7"
Vertical Travel — Knee	13½"
Rise and Fall of Spindle	4¼"
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

The Semi-automatic set up with air vise on a production job. Vise operated automatically by table movement.

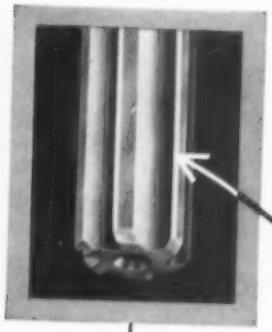
Write today for the Nichols general catalog, which describes the six models of Nichols Millers. A sound, color movie, "the Miller that Uses its Head" is available for free showing. May we reserve it for you?



MANUFACTURED BY W. H. NICHOLS COMPANY WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

76-F MAMARONECK AVE. WHITE PLAINS, N. Y.



This edge cuts reaming costs

L+I gives you the edge on production

Call your L+I distributor

The Reamer Specialists

L&I

LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Backlash

SEND LETTERS TO:
BACKLASH EDITOR American Machinist
330 W 42nd ST, N Y 36, N Y

No Honesty

Mr. R H, New York (*AM*—June 18 '56, p90) does not need to hide his light under a bushel. He is right, dead right, and his complaint of superficiality is fully justified. No matter where you turn, it is almost impossible to find someone who can do a real workmanlike job, whether it is fixing an automobile, or doing a job of plumbing or carpentry.

I bought a new tire the other day, and had it go flat within five miles because the "expert" tire man had pinched the tube between the tire and rim when installing it. A water faucet in my home was giving trouble, so I had it fixed by a top-grade, or rather a top-rate, plumber. After three days, the trouble was as bad as ever, so I decided to fix it myself. All the plumber had done was to install a new washer, but he had forgotten to replace the retaining screw. In less than half an hour I had dressed the washer seat, put in another washer and screw, and cured the trouble for just 7¢. But I had paid the plumber over $4.00.

From now on, I am going to "do it myself." It is not that I want to deprive an honest worker of his livelihood, it is just that there aren't enough honest workers to be found. Perhaps it is not their fault; they just haven't been properly trained or had instilled into them the pride of workmanship that is essential to doing a good job.

Wm Kennedy
Windsor, Ont.

Where Will It Stop?

For several years now, the American public has put up with being forced to accept unnecessary and unwanted doodads in order to purchase some basic item. The outstanding example, of course, is the automobile. The manufacturer adds several hundred dollar's worth of gimcrack trimmings, and then spends hundreds of thousands of dollars in advertising to try to make the public think that that is just what they had been wanting all their lives. And don't forget that the cost of all that advertising is paid for by the car buyer several times over.

Clearly, the disease is now spreading, and I see by your recent issue (*AM*—June 18 '56, p154) that even such utilitarian items as fork trucks are now being equipped with streamlined bodies, two-tone paint jobs, and chrome trim. Surely this is the limit. Or are we going to have to accept automatic cigarette lighters and per-

GRINETICS

By D G SMITH

APPROPRIATIONS COMMITTEE

BOX TOOLS

NON-CYLINDRICAL SHAPE

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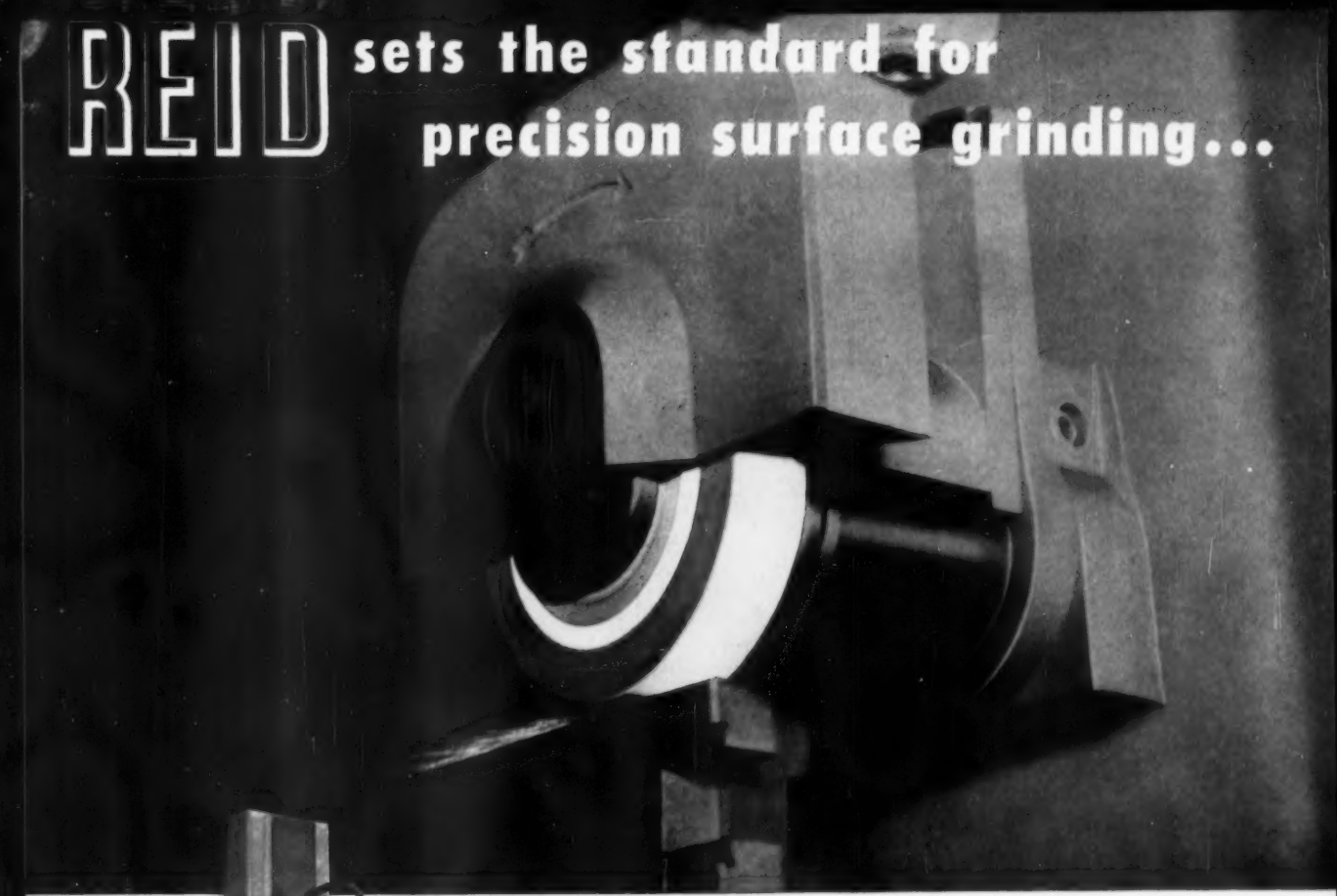
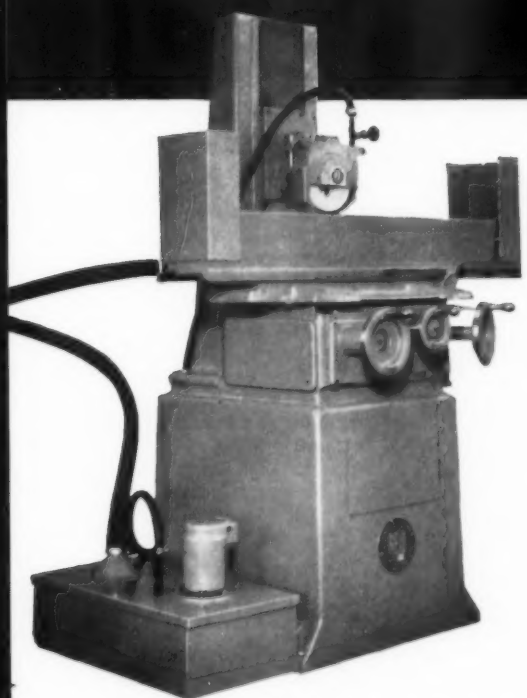
REID sets the standard for precision surface grinding...





MODEL 618H convenient finger-tip level controls for all operations make this grinder the favorite of the toolroom for the finest tool and die grinding. Accessories, including Cool-Grind or wet grinding attachments, magnetic chucks and form dressers give extreme versatility for all operations.

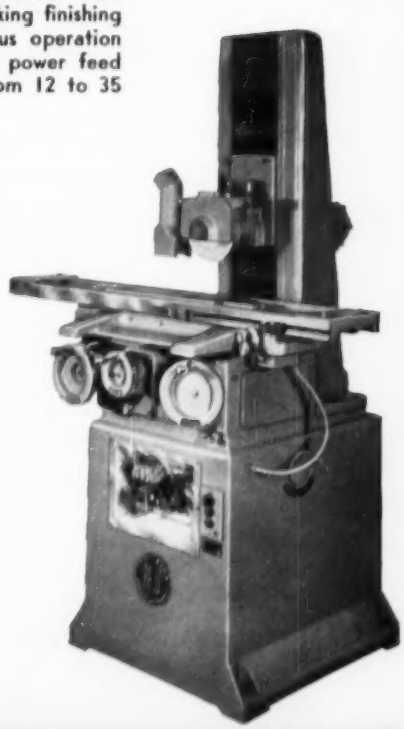
MODEL 618VL designed for precision grinding to the finest tolerances with superior surface finish . . . rugged construction and painstaking finishing give true dependability for continuous operation with minimum maintenance. Features power feed table with traverse speed variable from 12 to 35 feet per minute.

SPECIFICATIONS

CAPACITY: 6" wide, 18" long, 17¼" high from spindle center to table.
WORKTABLE: 51" x 8" overall.
FEED RANGE: Elevating hand wheel (r.) graduated to .0005" (optional, vernier to .0001"); cross feed to .001"; power cross feed adjustable .006" to .100" at either or both ends of table reverse.
GRINDING HEAD: with 3" opening for standard 1 h.p. cartridge type motorized spindle. Wheel size: 7" x ½" x 1¼".
FLOOR SPACE: 71" x 43½"
WEIGHT: 2100 lbs. net

Write for Bulletin 618-1

Photo courtesy of Robertson Mfg., Co.



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NOBLEWEST 50 ANNIVERSARY

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Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

haps cute little flower vases and hi-fi record players on our next-year's garbage-disposal truck?

I don't object to power steering, automatic transmissions, foam rubber seats, and 12-v electric systems. They will run up the cost, but they will improve efficiency. But when it comes to dolling up lift trucks just to make them pretty and increase the cost, I'll just forget about the new trucks I was going to buy, and keep the old ones until they fall apart. I have always favored planned replacement of equipment, but the first truck salesman that tries to sell me a black and pink combination with chrome trim will go out on his ear.

J A Macfarlane
Chicago

Plaintive Plea

Under the heading, "Why? Why? Why?" (*AM*—June 4 '56, p109) it says that not enough change in the 1956 models could be a reason for the auto industry slump, and uses the "completely-changed-in-1956" Rambler" as an indication.

Have none of the Mr Bigdomes considered that not everyone is getting rich in these boom times, and that perhaps a lot of us do not want to pay $3000 for a car? That we do not especially desire 300 hp under our toe; and that we might like to have a less expensive, more maneuverable, and easier-to-park car that gives increasingly important economical gas mileage?

Some of us are a little concerned about AMC's apparent tendency, despite their success, to follow the Big Three and keep increasing the size of the Rambler.

W B Lewis
West Hartford, Conn

Poly Confusion

Under Practical Ideas (*AM*—May 7 '56, p164) you published an item, "Bolt Circle Layout Can Be a Lot Eaiser." It is much easier to prove that the method suggested is wrong than it is to show a quick method for easy layout of all those bolt circles which can be laid out with dividers and straight lines.

For a circle of 1-in. radius, the line drawn in the left-hand figure to represent 1/7 is exactly 0.8660254 in. long. One side of a seven-sided poly-

gon inside the same circle would be 0.867767 in. Remarkably close, but not exact. The difference in a 72-in. circle would be considerably more than the required 0.003-in. tolerance.

I would suggest you give the boss a little credit for coming up with the correct answer.

In THEORY OF EQUATION, by Leonard E Dickson, p36, one can find rigorous mathematical proof that a regular polygon of seven sides cannot be constructed with dividers and straight lines.

Alfred Beck
Pomona, Calif

Ideas Wanted

In Diemakers Kinks, I would like to see discussed the over-all grinding of piercing punches up to $\frac{3}{8}$-in. dia. Where grinding is confined to small surface grinders and toolpost grinders, this seems slow and expensive, but it has to be done, at times, where I work.

Another subject—how to produce dowel-pin holes that will be the proper drive fit after the die members are heat treated. No slop, and little lapping afterwards. We use undersize reamers (0.005 to 0.001), fill the holes with asbestos, steel wool, or fireclay. Sometimes we get a tight fit, sometimes loose. Please do not suggest grinding the holes—our "fast and dirty" supervision would raise the roof.

V Priddy
Olympia, Wash.

Suggestion

AMERICAN MACHINIST is required reading in our shop, and every issue is passed along from the boss to the foreman, and on down the line. A lot of the stuff is way over the heads of most of the guys, mine too, but it isn't often that we get an issue without finding something in it we can use. Perhaps I'm getting out of line, but I would like to suggest that you could do a lot of us a big service by putting in some practical examples of shop mathematics, showing how to figure out things like the straight-line distances between holes when the drawing just gives them in a circle.

Wm Connolly
Cedar Rapids

NEW SERIES B

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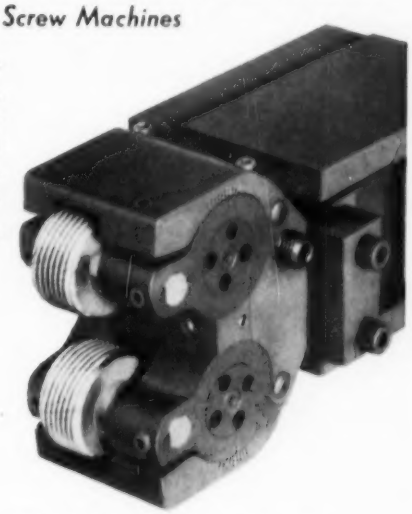
Provide Greater Versatility . . .

in THREAD and FORM ROLLING APPLICATIONS

on Automatic Screw Machines

A multi-purpose tool of wide range for rolling machine screw threads, straight and taper pipe threads (including dryseal), annular rings, oil grooves, knurling and other cold forming operations. Eliminates secondary operations by rolling behind shoulders.



- For over 100 different single and multiple screw machines
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- Easy to set up and operate
- Simple precision matching with prematched rolls
- Dovetail clamping arrangement simplifies setup by permitting head to be removed from adapter

SELF-COMPENSATING ROLL ACTION simplifies setup, provides longer roll life and reduces down time to a minimum. The ***side and alignment compensators*** ease undesirable side pressures on the rolls and assure smooth contact and withdrawal from the work. The ***advance compensator*** allows rolls of the same diameter to be used and permits either roll to contact the work first.

FOUR STANDARD SIZES

Model No.	Complete Diameter Range	*Pipe Threads That May Be Rolled	Approximate Number of Common Screw Threads That May Be Rolled
B 10	0-$\frac{5}{8}$"	7	80
B 13	$\frac{1}{8}$"-$1\frac{3}{16}$"	9	90
B 18	$\frac{1}{4}$"-$1\frac{1}{8}$"	15	105
B 36	$\frac{3}{8}$"-$2\frac{1}{4}$"	18	185

*Straight and Taper Pipe Threads, including Dryseal (NPTF). Change may be made from Straight to Taper Threading by changing rolls only. No other equipment is necessary.

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Where skilled workers feel so strongly about Starrett quality and dependability, why not go along with them? You get an extra measure of value, too, in products precision made by the World's Greatest Toolmakers.

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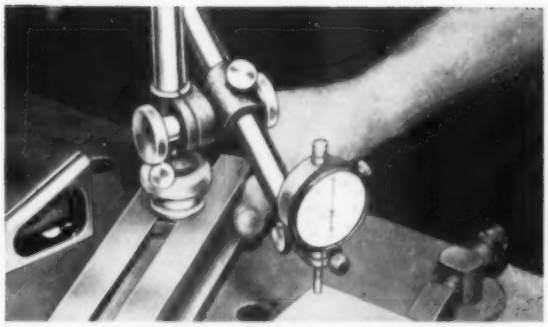
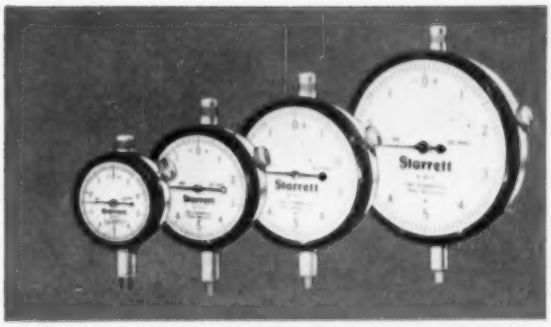


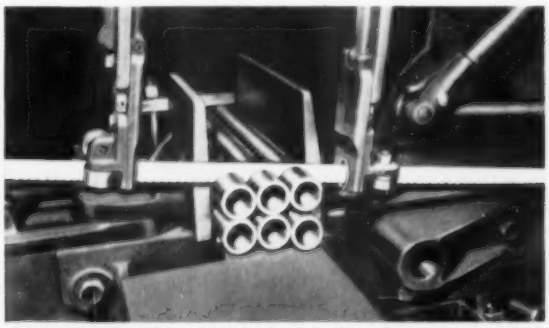
NEW HEAVY DUTY TEST INDICATOR

No. 675 with extra rigid construction has universal adjustment for quick positioning. 10″ base, $10\frac{1}{2}$″ base post and $8\frac{3}{4}$″ gage rod give it unusual stability and working range. Indicator normally furnished reads 0-25-0, graduated .0005″, range .125″. Other indicators available.



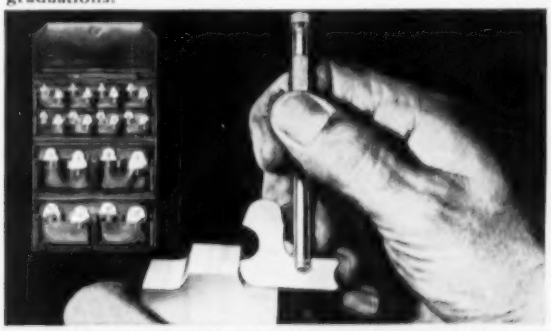
NEW HIGH-PRECISION, LOW-FRICTION INDICATORS

Featuring simplified construction; easy reading, egg-shell finish dials; no-glare Satin Chrome finish on case; black bezel. The complete line with 140 models to meet all requirements includes regular or nonshock types, balanced or continuous dials, jeweled or plain bearings, English or Metric graduations.



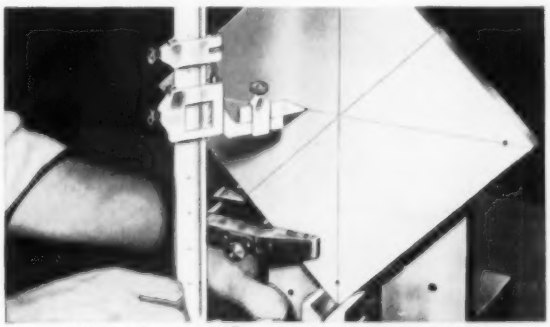
HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

Now production-proved to give faster cutting, longer blade life. Starrett wavy set band saw blade (pictured) makes short work of gang cutting pipes. Starrett-engineered blade construction means uniform cutting action, less chance of blade breakage or tooth stripping.



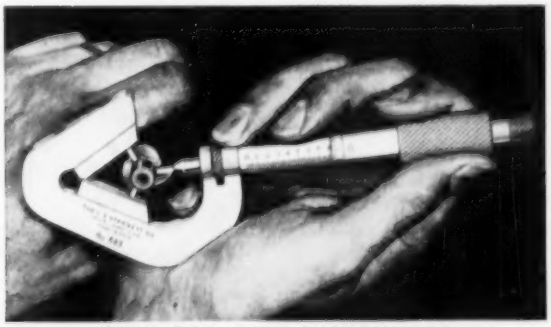
NO. 167 STAINLESS STEEL RADIUS GAGES

Made of stainless steel—rustproof and stainproof. Each gage has five gaging surfaces for convex and concave radii. Available in six convenient sets. Handy gage holder also available.



6, 12, 18 and 24″ VERNIER HEIGHT GAGES

Starrett Vernier height gages are standard equipment in tool rooms and inspection departments for layout, jig and fixture work and precision inspection. No. 454 (shown above) is available in 12″, 18″ and 24″ sizes. 36″ and 48″ sizes furnished on special order. No. 354 with slotted base available in 6″ size.



NEW ODD FLUTE MICROMETERS

No. 483 and No. 485 measure 3 or 5-fluted cutting tools, eliminate special fixtures. Read direct in thousandths. Satin Chrome Finish with carbide facings on anvil and spindle.

BIG NEW CATALOG NO. 27

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Spot news...

- **Ceramic tip cutting was demonstrated at Britain's recent Olympia Show** on both Monarch and Wickman lathes. Monarch, using an American ceramic tip, cut high-tensile steel at 1200 fpm, with feed of 0.01 and 0.050-in. depth of cut. Wickman cut carbon steel at 1500 fpm, 0.080-in. depth of cut and 0.012-in. feed. A 30-min cut created wearland of only 0.005 in.
- **Flint, Mich, auto workers' local pulled out of AFL-CIO** when the international tried to force election of new officers and set up an administrator over the local. The local (156 of the Allied Industrial Workers) will hold out temporarily as the independent "Foundry & Machine Workers Industrial Union."
- **Defense Dept has abolished all restrictions on use of tungsten in jet planes.**

Soviet Russia will produce 250,000 tons of machine tools in 1956, surpassing Britain, West Germany and perhaps the United States. It plans to double today's output by 1960. Russia would like to buy machine tools in the U S as well as Britain and hopes to arrange a visit to the U S machine tool industry, as well as to have a U S team inspect its machine tool plants. These and other facts are revealed by A I Kostousov, Soviet Minister for Machine Tools and Small Tools, in an exclusive interview in London with AM Editor Burnham Finney. Detailed story on p162.

- **Technical knowhow will be exported for the first time by Japan** when a West German steel-mill-machinery maker buys blueprints of a Japanese-invented machine that straps steel bars automatically.
- **Automakers report they have increased their parts inventories as much as 400%** since WWII. Buick, for example, has upped its parts inventory from 3.5 million in 1946 to more than 15 million today, and has increased number of types 50%.
- **British and European builders are beefing up horsepower on their machine tools** to the point where British and European-built U S machine tools now have about the same amount of horsepower as their made-in-America counterparts.
- **Two-piece coin ram for dimpling** that could save the aircraft industry hundreds of thousands of dollars a year is being patented by North American Aviation. It outlasts one-piece rams 3 to 5 times, costs one-seventh as much to replace.
- **Auto industry could stand a 60-day steel strike, aircraft industry 30 days,** without affecting output, with current finished-steel backlogs. Most automakers have enough steel to wind up '56 output, get well into '57 production.
- **Thickest pressure vessel ever made in Britain,** the Calder Hall atomic reactor, was done by welding 2-in. boiler plate under field conditions (no wind shielding, downhand welding almost impossible, no stress relief until weeks later).
- **Germany's Krupp is using this method to get a toehold in Mexican metalworking:** it will furnish Mexico's only maker of seamless-steel pipe with $1½ million worth of equipment on unprecedented 5-year, no-bank-guarantee credit terms. Krupp is reported to be offering similar liberal terms to other Mexican plants.
- **World's smallest TV camera is designed to locate faults in boiler tubes.** German built, the tiny (2 in. dia, 6 in. long) camera is equipped with springy rollers, is drawn through tubes by a perlon thread which is blown through tubes of less than 3 in. dia and radius curvature of less than 2 in. by compressed air.
- **Aluminum auto radiators will be generally adopted within three years,** according to Detroit insiders.

THE NEW STYLE NO. 48-B TOOL GRINDER is used for roughing and finishing large tools that do not require extreme accuracy. Also used for roughing or semi-finishing smaller tools.

THE NEW STYLE NO. 49-A TOOL GRINDER is a heavy-duty model. It is recommended for roughing and finishing large single-point tools or roughing smaller tools.

Simple operation allows quick training of inexperienced help—

There's a new Ex-Cell-O Tool Grinder to fit the needs of every shop, large or small. Designed for simple operation, you can quickly train even inexperienced help to become proficient at tool reconditioning.

Ex-Cell-O Tool Grinders accommodate a wide range of tool sizes and sharpen all grades of carbides, high speed steels, and cast alloys. They feature: sturdy construction, vibration-free operation, generously proportioned work tables, simple and exact angular adjustments, and table adjustment for wheel wear. All models are double end with reversible motors for left and right hand tools.

New Ex-Cell-O Tool Grinders

GIVE YOU THE FINEST CUTTING EDGES

THE NEW STYLE NO. 46-D TOOL GRINDER can be used for finish grinding and also for roughing small and medium tools.

THE NEW STYLE NO. 44-A TOOL GRINDER is a precision finishing grinder. An Ex-Cell-O Precision Spindle drives six-inch plate mounted wheels.

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AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-14

Washington ... NEWS REPORT

Hassle over $900 million . . .

Though Defense Secretary Wilson says he won't "impound" the $900 million added to the Air Force appropriation, he refuses to say whether he will allow the Air Force to spend the extra money this year (see p169). Wilson's stand strengthens the Democrats' political issue on defense. When President Truman impounded a like amount of money six years ago, the national temper over defense was relatively low-keyed.

This time, the situation is different. The Symington investigation has built up a dramatic case of U S inferiority vis a vis Russian airpower. Top-level Air Force brass, for the most part, have backed up the charge and have put the finger on lack of money as one big reason.

Shift in fiscal policy . . .

Whether or not the Pentagon spends the extra $900 million, the trend in government expenditures—defense and elsewhere—is up. For the first time since taking office three years ago, the Eisenhower administration is now operating under a budget calling for increases in overall spending, not reductions. This is a fundamental shift in Washington's fiscal policy.

For industry, this means at least 12 months of rising federal spending, with indications that the upward trend will continue indefinitely. The period in which declining federal outlays served as a drag on the economy is over. From here on out, spending policy will be on the side of stimulation. And unlike increased spending during the Roosevelt and Truman administrations—which came out of deficits—the present administration feels the increases can be met from a Treasury surplus. Right now, there's plenty of tax revenue to provide the larger dollar outlay and maybe leave something to lower the debt.

Industry outlook . . .

Commerce Dept's mid-year industry outlook for the remainder of 1956 is "favorable"—despite "some soft spots." Following is a breakdown by industry:

• **STEEL**—operations next half are expected to average about 85% of capacity, compared to 99% the last six months. This brings total ingot output for the year up to last year's record 117-million ton level.

• **AUTOMOTIVE**—passenger car output will likely come to 2,815,000 units during July-December, bringing the total year's production to 6-million units, the fourth best in industry history. Signs are that dealers' 1956 inventories "will be normal for 1957 introductions." Truck production will "continue strong"—with a 62% increase over last year anticipated for heavy-duty trucks.

• **AIRCRAFT**—order backlog is now $15 billion—20% civilian—compared to $13.5 billion last January.

• **SHIPBUILDING**—total tonnage of ocean-going vessels under contract is 437,160 gross tons, up 233,400 over last year. But this is less than 50% of "normal good volume" for the industry. Unless restricted by steel plate shortages, inland waterway barge and towboat construction are expected to remain at their current levels.

• **RAILROAD EQUIPMENT**—backlog is 137,436 units. Present production rate is about 6000 monthly, will remain so, as long as enough steel is available. Locomotive backlog of 938 is the highest in more than three years.

• **MACHINERY**—construction, order backlog is 10% above months ago; mining, "demand will remain strong"; oil field, will be up 10-12%; farm, production next six months will fall, total sales will likely be 15-20% less than last year; power, total sales will reach a new peak this year.

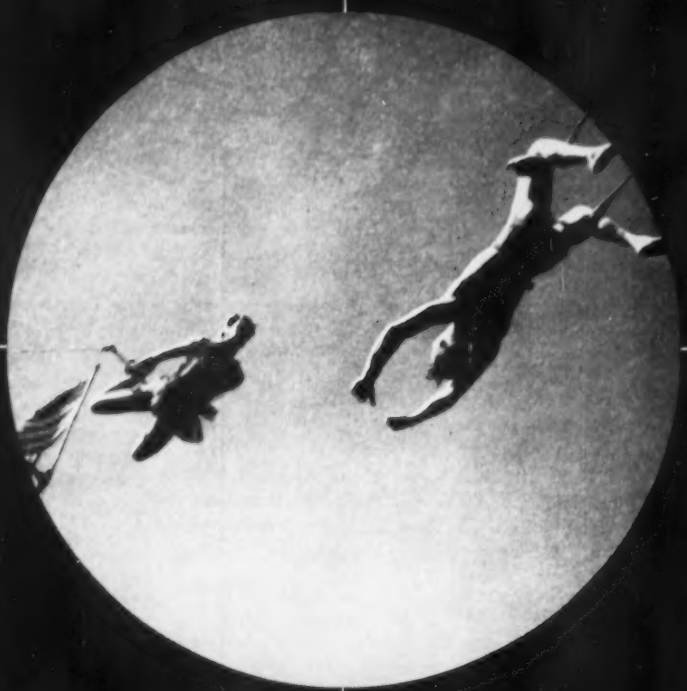
Labor outlook . . .

A wage settlement in the steel industry—when it comes—will mean a less-than-usual jolt to the nation's collective bargaining pattern. Several industries are directly tied to a steel contract pattern, but others aren't going to be following along this year. Aluminum and steel fabricating industries, where the striking United Steelworkers Union also represents the employes, will not only feel the economic effects of the strike but also of the settlement. The terms in steel will be carried through in these two other industries.

But the normal pattern stops there. One of the usual major follow-up industries, non-ferrous mining, is already wrapped up. New three-year contracts have been signed to beat the contract deadline with the Mine-Mill and Smelter Workers Union. Generally, Mine-Mill has ridden the coattails of the Steelworkers Union.

The biggest factor in the failure of the steel industry to set the pattern is wages. Settlements so far this year are running high, with the biggest percentage in the 10-12¢-an-hour range. Wages in steel won't be boosted by more than this, no matter when the contract is signed. So, other unions aren't going to wait for the strike-ending agreement. They've got the high average to shoot at.

BAY STATE



PRECISION PERFORMANCE...

To the aerial artist, precision performance is a matter of life or death.

To tap users, precision performance means production-line continuity, better threaded parts, increased tap life . . . and BAY STATE!

BAY STATE TAPS

Bay State Tap & Die Company

Mansfield, Massachusetts

On the shelves of your local Industrial Supply Distributor

Detroit ... NEWS REPORT

Insurance against a repeat of '56 . . .

No single cause has been decided upon, but most industry men feel that the 1956 cars just weren't different enough. Various schemes have been studied in an effort to arrive at an economically feasible major styling change every year. One group favors a complete overall change each year, while others advocate a major face-lift.

Is is agreed that if you really catch the public fancy the tooling cost is no problem—but if you miss! The solution that appears to be emerging now is that of a major face-lift every year on a body that can be retained for three, four or even five years without tooling expenditures for the basic shell.

The body shell will be the much-discussed unitized body. The safety feature will be played up by the advertising men but economy will be the real reason behind its acceptance. Car stylists will be able, because of the larger margins of safety, to use lighter and different materials—aluminum and plastics.

Aluminum will find increased use, not only for trim but also for body structure, and plastics could be used wherever the underlying body shell provides the needed strength.

Lincoln's 1958 models will feature the new unitized body, and at least one line in each of the Big Three will do the same for 1959.

Family look for the Thunderbird . . .

The word around the Thunderbird Club is that the 1957 models will be the last of the true Thunderbirds, and that it will become a four-passenger, family sports car.

The Thunderbird will lose the "personal car" identification that has made it such a success, but Ford should be able to sell everything it makes if it does go to the four-passenger model . . . the car and the styling are that popular.

Speaking of the upcoming 1957 model, one engineer said, "The '57 looks like it probably looked when it was first born—before it was changed by the brass."

'56 output may hit 6-million . . .

It is no surprise that the industry will fall far short of the 1955 model run but the production of over 5-million cars by the end of June indicates that the 1956 totals may well exceed the 6-million mark predicted by some industry economists.

General Motors leads the field with 54.3% of the total market—up 5% from last year. Chevrolet has 27.3% of the total market, followed by Buick with 10.3%. Olds, 8.0%; Pontiac, 6.1%; and Cadillac with 2.6%.

Ford commands 26.8% of the market—a slight rise from 1955. Ford claims 21.6%, and Mercury, Lincoln and Continental, in that order, make up the difference.

Chrysler is down about 4% from last year. In the Chrysler house Plymouth leads with 7.8%, followed by Dodge at 3.3%; Chrysler, 2.0%; and De Soto at 1.8%.

American Motors is off a little, claiming about 2.1% of the market as against the 1955 figure of 2.5%.

Studebaker-Packard dropped considerably, falling from 2.8% in 1955 to 2.0% in 1956.

A satisfactory clearance of 1956 models is expected as production, though stepped up for the third quarter, is being restrained to allow clearance of the current line as the sales picture brightens.

With few exceptions, the 1956 model runs will end in September. Chrysler will probably stop near the end of July, with Dodge and De Soto finishing early in August. Packard stopped last week.

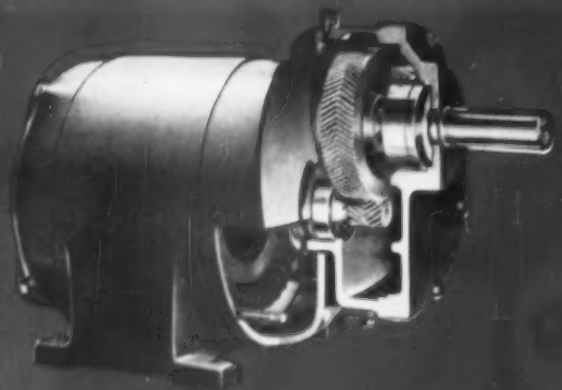
More plastic auto parts?

According to Chrysler Corporation the trend of the automobile of the future offers plastics manufacturers a tremendous potential market. Behind this opinion are three facts:

- The trend toward increased use of transparent materials in the upper half of car bodies—for maximum light and visibility.
- The greater use of "lifetime" parts which require no service or replacement.
- The ever-continuing effort to reduce car weight. Cost has remained the biggest problem of the plastics industry but this is steadily being whipped. Today, Chrysler is using plastic water pump impellers, heater housings, and nylon bearings. At the moment, about 250 components on automobiles are made of plastics.

Taxicabs switch to automatic transmissions . . .

Dodge Division of Chrysler says that about 80% of the taxicabs it delivered in 1955 had standard transmissions. So far this year about 85% of the cabs sold by Dodge have had automatic transmissions. While speaking of taxicabs we note there is a trend toward air-conditioned cabs—and it's about time.



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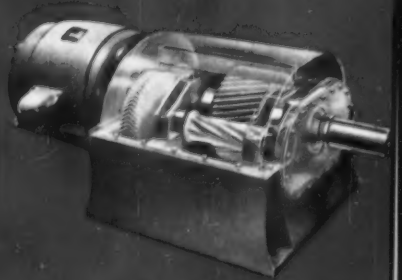
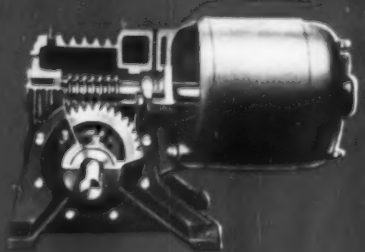


DOUBLE REDUCTION
Parallel Shaft Type



SINGLE REDUCTION
Right Angle Shaft Type

THE MASTER ELECTRIC COMPANY

Dayton 1, Ohio

NEWS REPORT

Machine tools ...

Best of all Olympia shows . . .

Britain's International Machine Tool Exhibition was an exciting affair this year—the best Olympia show the British have staged on a four year cycle in 1948, 1952, and 1956.

Olympia could well have been a letdown this year, what with following four annual European shows, the German Show at Hanover in 1955, and of course, our own Machine Tool Show last September.

But it was anything but a letdown. If anything, it was even more impressive than anticipated—with a number of brand new machine tools on display that have never before been shown anywhere. Several U S machines were in this category. (Details on p165.)

Transfer machines made in England and on the Continent were part of the exhibition. So were punched-tape control machines. Though few in number, they represented one of the most significant trends today in European machine tool design.

But automation was not as widely and spectacularly designed into the machines at Olympia as it was at Chicago last September.

Nevertheless, the amount of automatic handling of parts into and out of machines was impressive. And it was indicative of the growing use of automation devices in Europe.

British machines predominated at Olympia, of course, but German machines were on display in impressive numbers, too, and U S machines were prominent. No figure is available as to how many U S machines were shown . . . but it's especially intriguing to note how many of them were being built in England.

The Russians were there, too . . .

The presence at Olympia of a delegation of 20 Soviet technicians, headed by Soviet Minister Kostousov, Machine Tools and Small Tools, was of particular interest. Because the Olympia Show had more new developments than the Russians thought it would, they prolonged their visit beyond the scheduled time.

$1 Billion orders this year?

The machine tool industry gives promise of coming reasonably close to the $1 billion mark in net new orders booked in 1956.

New orders January-May inclusive totaled $445 million—for a monthly average of $88 million. If one wishes to be conservative in figuring ahead and puts the monthly average for the final seven months of the year at $75 million, the full year's bookings will total $970 million.

Shipments too should make a good showing for the year. Up through May, they amounted to $342 million.

If shipments from June to December are projected at the May figure ($76 million), 1956 output of machine tools will be $874 million.

New orders for forming and shaping machines will be $138 million during the second half of the year, the Department of Commerce estimates. The first half was $148 million.

Shipments of forming and shaping machines are put at $130 million for the last half, as against $131 million in the first half.

ODM okays 60 pool orders . . .

Some 60 pool-order contracts for machine tools (the so-called trigger program) have been approved by the Office of Defense Mobilization. At least 30 more contracts are scheduled for ODM blessing.

Most builders of general-purpose machine tools are expected to be brought into the program. In fact, the program is limited to general-purpose machines. Purchases of special machine tools are to be financed out of military funds, as a part of end-item projects.

Pool orders do not begin to operate except in case of full mobilization. The total contemplated program, to cover needs for the first six months of an emergency, runs to $256 million. This compares with an outlay of $1.4 billion during the Korean war.

Slate Purdue tool conference . . .

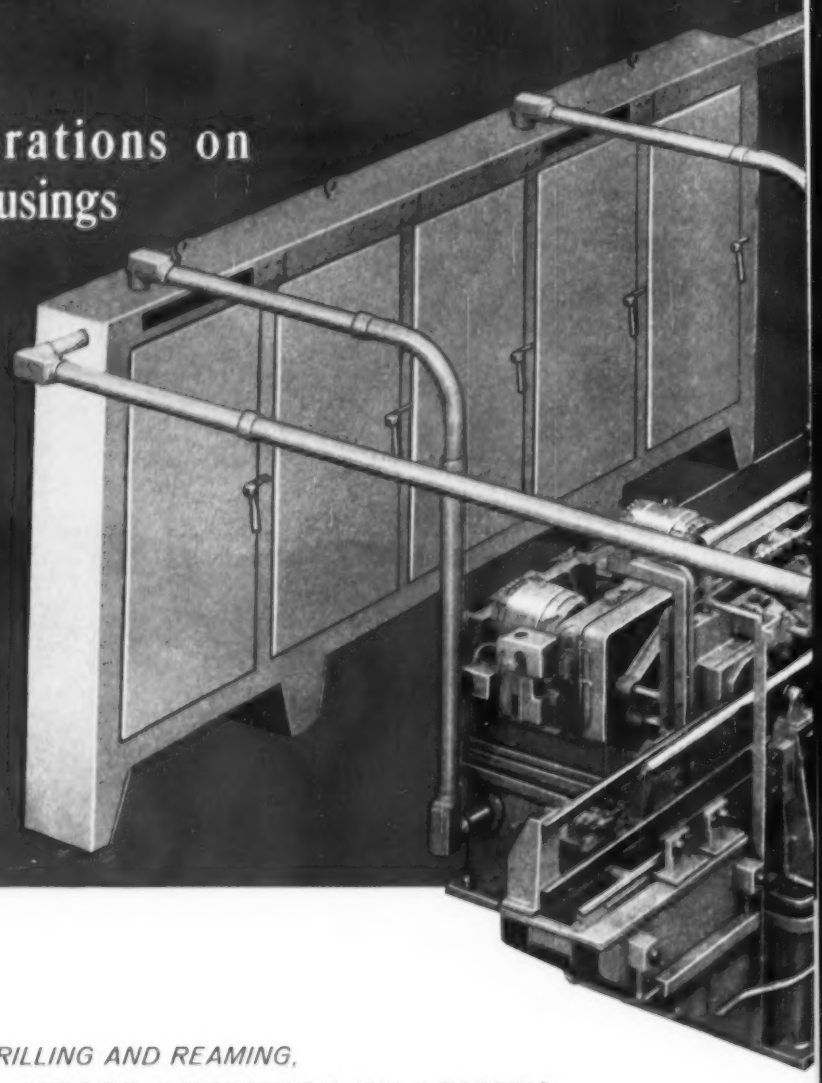
The well-established annual Machine Tool Sales Conference, attended by builders' and distributors' salesmen, will be held at Purdue University July 30 to August 3. Sponsored by the National Machine Tool Builders' Association and the American Machine Tool Distributors' Association, it was omitted in 1955 because of the Machine Tool Show.

Professor Harry J Loberg of Cornell again is the educational director, while Professor O D Lascoe of Purdue has charge of all arrangements. So many have registered for the conference that it will be necessary to divide the group into two sections for certain classes.

BF

Buhr ECONOMATIC

performs 62 operations on torque converter housings



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AT 100% EFFICIENCY

OPERATIONS...
36 DRILLING, 2 COMBINATION DRILLING AND REAMING,
7 COUNTERSINKING, 2 REAMING, 1 BORING, 7 INSPECTION AND 7 TAPPING

- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts
- Mist-lubrication to all spindles to maintain uniform temperature in heads
- All spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- All standard and special parts interchangeable for ease of maintenance
- Machine conforms to J.I.C. Standards
- Hardened-and-ground automatically-lubricated steel ways.

BUHR MACHINE TOOL COMPANY©

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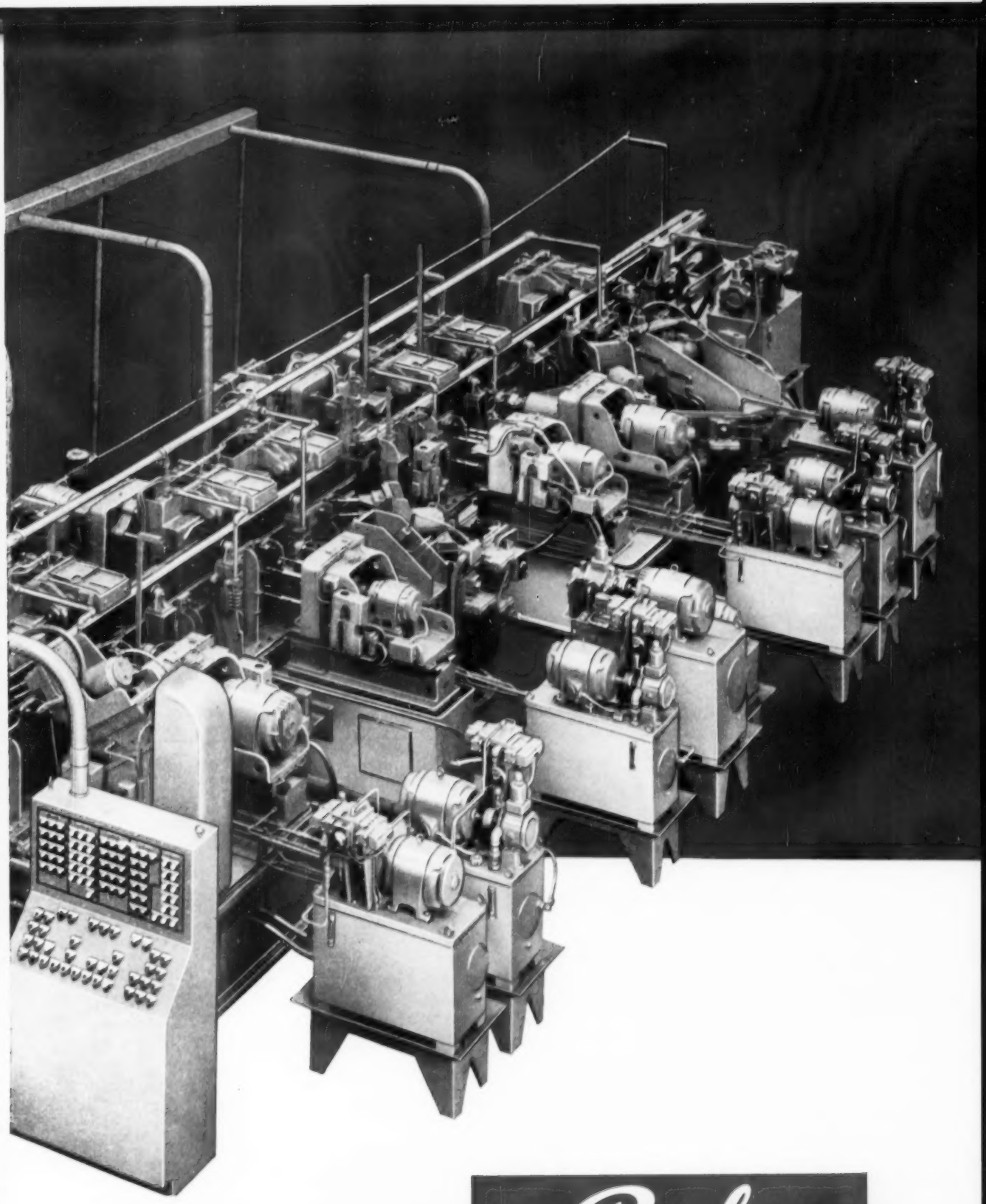

Buhr

MULTIPLE-SPINDLE
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Excellent tool life... high quality threads

A prominent nipple manufacturer in Texas (name on request) manufactures nipples from seamless tubing, galvanized pipe and heavy wall tubing—in sizes from ⅛-inch to 8 inches. Landis Dual Head Automatic Threading Machines are used.

Because of the difficult nature of this operation—the manufacture of high pressure, precision fittings—Texaco Lubrication Engineering Service selected *Texaco Sultex Cutting Oil A*—an active sulfur-type oil especially designed for high-speed threading, broaching and tapping. Results have been: excellent tool life, high quality threads, high production rate.

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TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

What's ahead ... in Metalworking

NEWS REPORT

Impact of steel strike on Metalworking . . .

Steel warehouses had a normal inventory when the strike started except for three critical items: structurals, shapes, and plate. These three are non-existent for all practical purposes. Other items (estimated at 2.5-million tons) would normally last four to six months.

But orders are flooding in from buyers who usually get supplies direct from mill. Warehouses can be expected to scale these down to protect their regular customers. Even so, it looks like warehouse stocks will only last four to six weeks, if the strike continues. The BDSA order allocating certain types to defense orders cuts off this source for many plants.

Plants that have steel inventories can be expected to try to get steel from warehouses, to resort to their inventory only when they have to. Typical is a screw-machine products company that uses 20 tons a month. The owner says he has 40 tons housed in a garage and won't start using it so long as his warehouse supplier can furnish what he needs.

Crippled markets, rather than steel shortages, are the fear of many companies. The almost complete lack of plate and structurals may be expected to cause cutbacks in orders for parts made from bar and sheet.

Heavy equipment hit first . . .

Builders of machinery and equipment using plates and structurals will be hit first and hardest by the steel strike. Most were having trouble getting supplies to keep production lines moving and thus have little or no inventory.

However, one press builder has plate for eight weeks at current production rates. Deliveries for September and beyond will have to be rescheduled if the strike is prolonged.

In contrast, another press builder expected to operate only 10 days unless plates could be found.

Any scramble for steel when the strike ends will be held in check by price increases. Inventories will then come out of hiding and go into production. This should ease the strain during the period when pipelines are refilling from the mills—except in the three scarce categories.

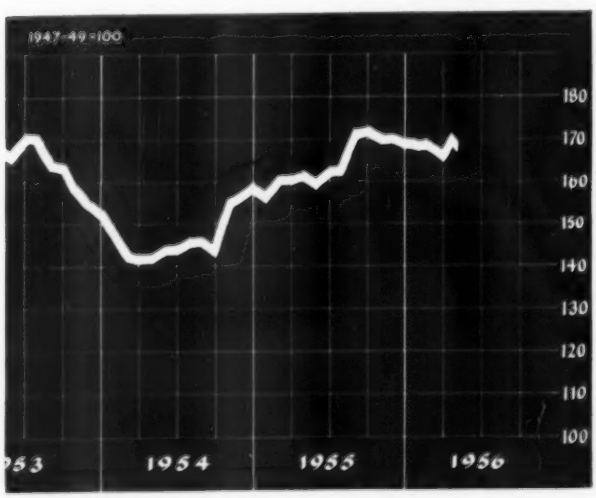
Business outlook still good . . .

Best bet is still for a slow third quarter followed by a pickup that will make the second half about equal to the first.

Appliance sales picked up noticeably in June and inventories are now near normal for this season. One maker is selling 22 to 25% ahead of this time last year, is confident the year will end 25% ahead.

Major appliance field seems to be shaking down to a half dozen major suppliers, each producing a complete line of "white goods". One company that recently went out of the business did so because of inability to sell a partial line.

Growing prevalence of vacation shutdowns will cause a seasonal cutback in production this month. This will tend to postpone the impact from the steel strike. And in gaging trends from July production, remember that vacation closings will make output artificially low.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

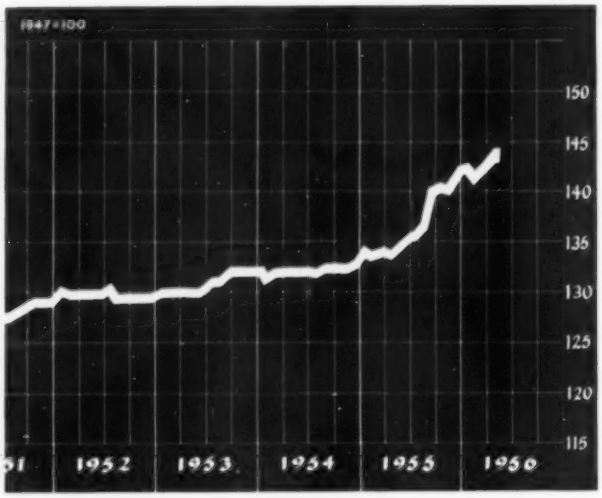
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total Index.	**167**	**168**	**171**	**162**
Machinery	150	151	134	
Electrical Machinery	206	209	184	
Autos	116	129	157	
Other Transportation	314	308	278	
Other Metalworking	141	140	135	

NEWS REPORT What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total Index	**143.8**	**143.7**	**143.5**	**134.7**
Metalworking Machinery	164.9	164.3	149.0	
Other Machinery exc. Electrical	150.7	149.5	139.5	
Electrical Machinery	141.2	141.2	131.7	
Fabricated Metal Products	137.5	137.8	130.8	



'56 May wind up as our greatest year . . .

Barring a prolonged steel strike that could tip the year's economic balance unfavorably, 1956 may well wind up as the biggest year in U S economic history.

That's based on a fast-rising U S Gross National Product which, again barring a long steel strike, gives every indication of topping even 1955's tremendous records. Even setbacks in such giant industries as automotive and farm equipment, and possibly appliances, will fail to deter the general rise in all U S goods and services.

Soft goods are doing well . . .

The non-durable goods industries are chalking up some record highs this year.

For instance, the not-so-long-ago distressed textile industry is putting two good output years back to back—with textile mill output running about 5% ahead in the first half over 1955—close to capacity. And although the second half may not quite equal the first (inventories are increasing and output of synthetic fabrics has slowed a little) the year as a whole is expected to be a record one—4% ahead of 1955.

Food and beverage output is expected to increase about 6% in physical volume of sales over last year. That, of course, is the industry's own estimate. It may be a little on the optimistic side, but not much.

Construction materials (cement, glass, brick and gypsum products), a good indicator of future properity or decline, for the first half of the year ran almost 12% ahead of the comparable period in 1955—in spite of a decline in residential construction. This, however, has more than been offset by a jump in heavy construction, and building and building materials should top all previous records by 1956's end.

WEEKLY BUSINESS INDICATORS

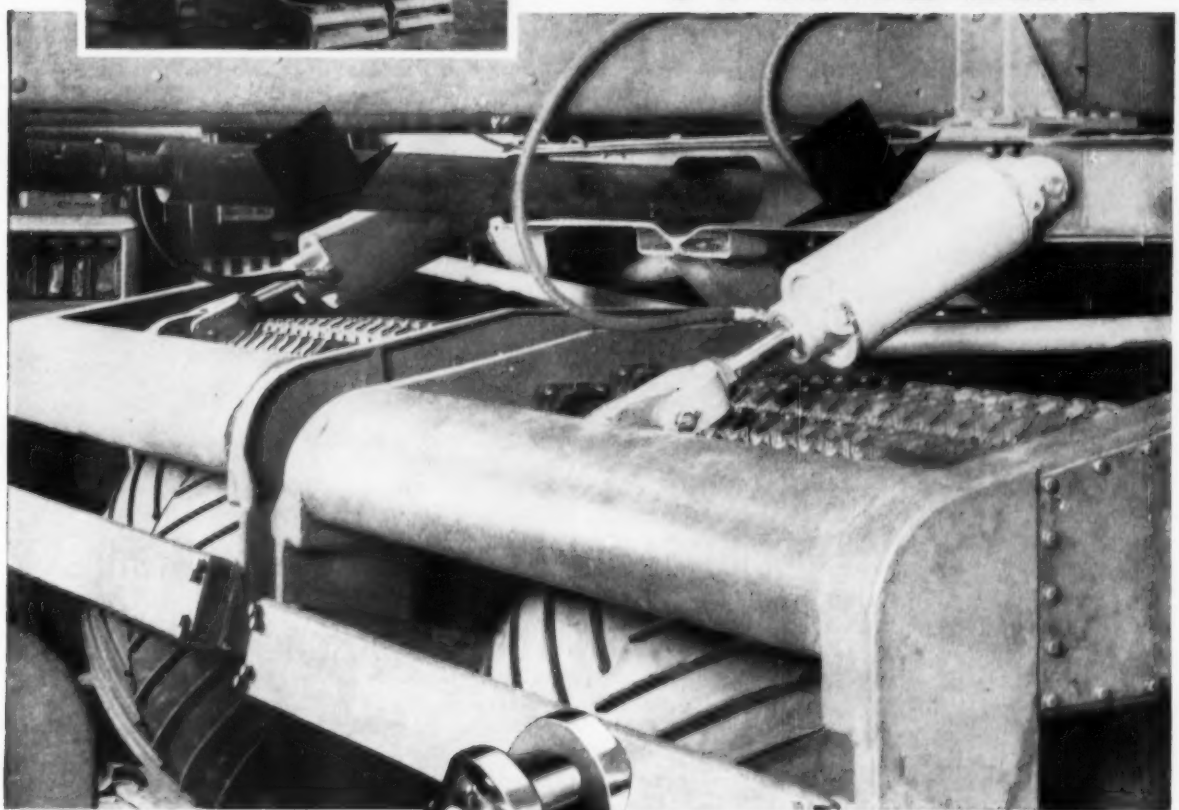
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	148.8	148.5	143.5
Steel ingot production (thousand tons)	320	2,090	2,073
Electric power output (million Kilowatt hours)	11,498	11,478	10,138
Production of automobiles and trucks	134,432	139,823	195,071
Engineering construction awards (Eng. News-Record millions)	$390.0	$415.9	$378.9

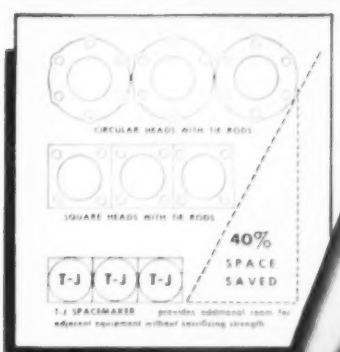
MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	334	381	364
Vacuum cleaners sales (thousands of units)	353	396	244
Washers sales (thousands of units)	324	406	313
Household electric ranges sales (thousands of units)	115	118	109
Radio production (thouands of units)	983	1,360	1,160
Television production (thousands of units)	550	680	583
Gear sales index (1947-49=100)	264.7	276.5	179.8
Foundry equipment new orders index (shipments, 1947-49=100)	135.2	152.7	178.6

* Seasonally adjusted.

Arctic Cargo Carrier Depends On T-J *Spacemaker* CYLINDERS





Saves 40% Space!
No Tie Rods For Greater Strength

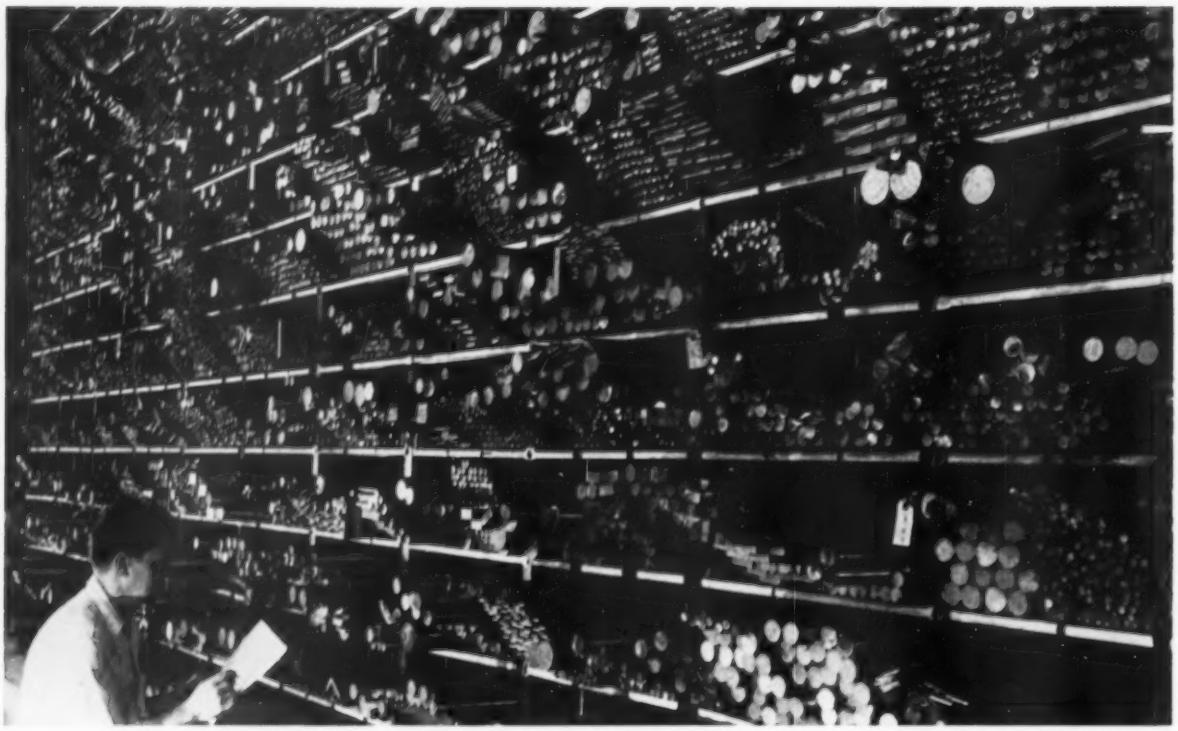
Differential axle loading through T-J Spacemaker Air Cylinders forms a controlled walking beam in this Teracruiser, designed and produced for the Army Ordnance Corps by the Four Wheel Drive Co., Clintonville, Wis.

Weight of cylinders was important factor in choosing T-J Spacemakers, which reduce weight while providing same displacement and extra high safety factor. Fast delivery and space-saving features also favored T-J. Exclusive with T-J are new Super Cushion Flexible Seals for Air (to 200 P.S.I.) . . . and New Self-Aligning Master Cushion for Oil (to 750 P.S.I.). Hard chrome plated bodies and piston rods are standard, at no extra cost. Wide range of styles, capacities . . . 64,000 combinations *off the shelf!* Write for bulletin SM-155-3. The Tomkins-Johnson Co., Jackson, Mich.

ALL MODELS . . . OFF SHELF DELIVERY

MEETS WITH ALL JIC RECOMMENDATIONS

T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS



17-4 PH

17-7 PH

17-14 Cu Mo

17-10 P

Special Stainless Bar and Wire Grades Available **NOW** Through Armco Distributors

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He'll rush your orders for standard shapes, sizes and grades from his complete stocks, which often include special Armco precipitation hardening grades (17-4 PH and 17-7 PH) and extra-low-carbon stainless. If these or other special Armco Stainless grades (such as 17-10 P or 17-14 Cu Mo) aren't on hand, he will get them for you promptly.

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What's more, his technical service costs you nothing. He will be happy to help you select the proper stainless grade, or supply you with specific literature from his complete library of Armco Stainless fabricating booklets.

If you don't know the Armco Distributor in your area, let us help you get acquainted with him. Just write and ask us for his name and address.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

One way you can't lose

What measuring stick do you use to decide whether you should replace or retain machines in your shop?

If your answer is "I don't have any," or "I don't need any because I do a pretty good job by rule of thumb," you had better bring yourself up-to-date on what is going on.

Using a formula these days for determining replacement is not a device of the highbrows. You don't have to be an engineering graduate, with an A in higher mathematics, to understand and to employ a formula intelligently. That is a myth that has been promoted falsely by some people.

If you are capable of doing eighth-grade arithmetic, and most all of us are, you will be able to make the necessary calculations without any trouble.

The daddy of them all . . .

is the formula developed by the Machinery and Allied Products Institute. With only a few exceptions, the others are variations on it. Some users of production equipment—Allis-Chalmers, Caterpillar Tractor, Cooper-Bessemer—have their own adaptations of the MAPI formula. Some machine tool builders too have devised their own formulas which are modifications of MAPI's.

In practical use, any of these formulas consists essentially of a printed sheet or two divided into two columns in which you put down figures and then add and subtract.

The formula puts the old machine "on the spot." It is in the position of being the defendant. The new machine is the challenger—on the basis of cost-per-piece produced, maintenance expense, and a number of other factors.

When you get through with your pencil, you will have either a profit or a loss, but probably will not have the final answer. Good judgment is involved too. Even with a good formula, you still cannot, in effect, put a set of figures into a mechanical calculator, press a button and have the right answer come out on a printed slip.

The purpose of whatever formula you use is not to do all the thinking for you. Its principal value is to act as a guide in timing properly your replacement of old machines and to stimulate regularized rather than hit-or-miss consideration of replacement.

You cannot possibly put down . . .

in a row of figures certain benefits derived from installing new and better machines, such as the satisfaction that operators get from working in a modern shop. This is one of the reasons why a formula is not infallible.

Then, bear in mind that some of the factors vital to the working of the formula are based on assumptions rather than on hard-and-fast facts. For one thing, you estimate the number of hours the new machine will be working the first 12 months and even over a period of years. You cannot afford to be a slave to the formula. Its overuse is just as bad as not using it at all.

The main point is . . .

that you cannot lose by employing a formula as a rough measuring stick to decide upon replacements, even though any formula has shortcomings. You can only do a better job than otherwise you would be doing.

A growing list of blue-ribbon metalworking companies is using some kind of formula. Each of these companies feels that the formula-idea has high merit and should be an integral and valued part of its program for deciding upon replacements. If you have not yet done so, why not join the group?

Burnham Finney EDITOR

CINCINNATI Shears at PRATT & WHITNEY AIRCRAFT

meet terrific demand for jet aircraft engines . . .

The right tools for the job were needed at Pratt & Whitney Aircraft, in their tremendous expansion, in the production of the highest power turbojets.

Cincinnati Shears are used in this program. Their accurate performance and ability to shear a wide variety of materials decided their selection.

Investigate:

- Cincinnati "Single Clearance" Shearing
- Cincinnati Hydraulic Holddowns
- Cincinnati All-Steel Interlocked Construction

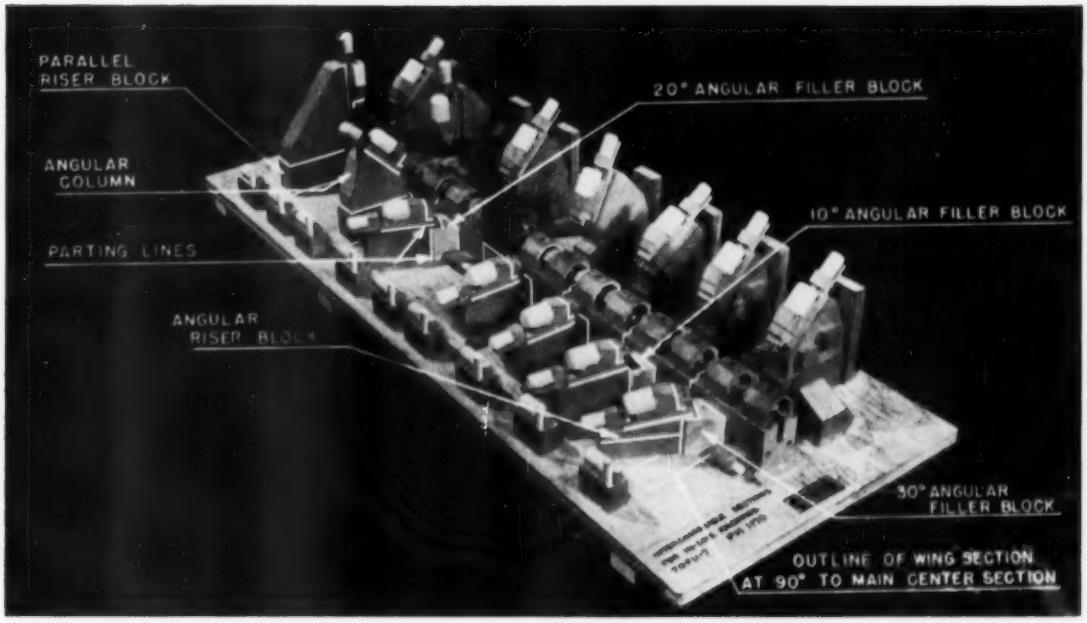
Write for Shear Catalogue S-4.

Materials being sheared in these illustrations are .093 Nimonic and .050" 3810 stainless steel.

Photos courtesy Pratt & Whitney Aircraft, East Hartford, Connecticut and Convair, San Diego, California.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES


PARALLEL RISER BLOCK
ANGULAR COLUMN
PARTING LINES
ANGULAR RISER BLOCK
20° ANGULAR FILLER BLOCK
10° ANGULAR FILLER BLOCK
30° ANGULAR FILLER BLOCK
OUTLINE OF WING SECTION AT 90° TO MAIN CENTER SECTION

PERSPECTIVE VIEW of Ford's model of in-line machine built up from interchangeable sections. Wing sections differ in type and sequence from the view on the following page. Parting lines illustrate the various unital separations which comprise the wing sections

Ford says:

"Let's have 'building-block' machine tools"

American Machinist

RUPERT LE GRAND, senior associate editor

Ford is going in for "building-block" machine tools. It has placed an order for so-called "unitized" machines, and these will be the forerunners of many more that, taken as a whole, will revolutionize Ford's specifications for machine tools and will give tremendous flexibility to its machine-tool facilities.

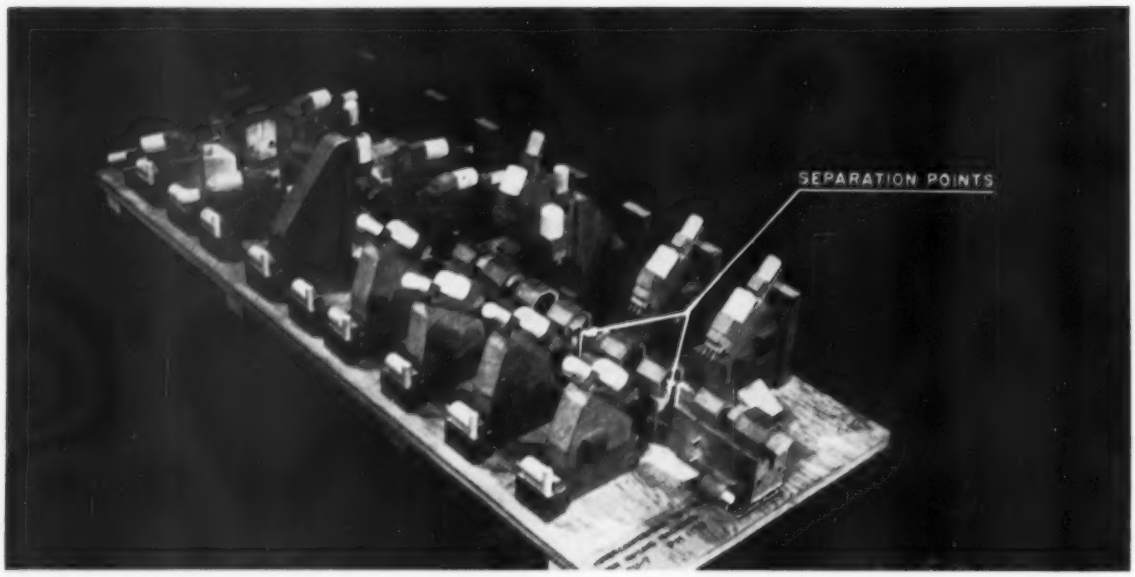
This plan has not been evolved overnight. Ford's engineers have been working on it for a long time. The main objective is to introduce flexibility into the design of in-line transfer machines and of other high-production machine tools to make car-model changes less costly than they have been in recent years.

In "general standards" shown to machine-tool builders and circulated within its own organization, Ford calls for sectionalized units *with standardized dimensions* insofar as they affect rearrangement of the sections. If certain physical dimensions like spindle heights and mounting dimensions are standardized, true interchangeability of units—the base sections, wing sections, columns, heads, power units—can ultimately be realized, regardless of make.

No thought exists that users should dictate design features to machine-tool builders. Rather, the Ford people hope that standardization of dimensions of machine-tool units, to attain interchangeability and freedom of rearrangement, will be brought about by voluntary cooperation of builder and user groups. The auto company certainly does not want "frozen" designs.

A precedent exists in the form of standards for presses, as issued by the Joint Industry Committee. In this case, engineers from the press builders and the automotive and other large press users worked out the details of standardized tooling-space and die-mounting arrangements by years of effort. The purpose of the program was to permit interchangeability of dies from press

"Let's have 'building-block' machine tools" . . .



BY REARRANGING THE "BUILDING BLOCKS," and adding or subtracting the components, the in-line machine now copes with a different series of operations. Wing sections can be pulled back from the central main sections to accommodate different or, if necessary, wider fixtures. Main sections can be separated, even rearranged to change position of index and roll-over stations

to press regardless of make, and to avoid any restrictions on press development and design features.

It will take years of effort to achieve a similar degree of standardization of boring, drilling, reaming, milling and tapping heads, machine bases, columns, etc, so they can be interchangeably mounted or conveniently rearranged as in-line machine tools and other special-purpose machine tools. Spindle heights, baseplate areas, and mounting details vary widely from maker to maker. To accomplish standardization, it will be necessary for builders to spend much design time, to make new patterns and fixtures, and to load additional tasks on their leading engineers and executives.

Machine-tool builders may feel that such a program will cause their designs to lose individuality and perhaps sales leadership. They might believe with a certain amount of justification that standardization of the kind suggested will open up the market to all comers and perhaps even stultify design achievements. And, obviously the standardized heads, beds, columns, etc, would have a longer useful life, which works against the rapid introduction of new achievements, as is the case when several builders are called in to suggest the equipment and to enter bids for a new production line.

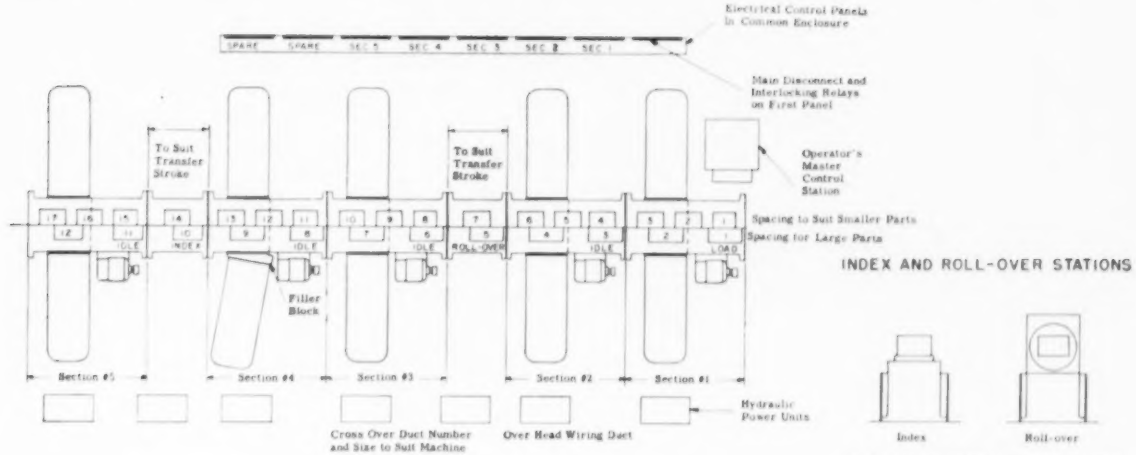
That something may have to be done along the lines of Ford's proposal is already painfully evident in the automotive and other mass-production industries. Until recently, an auto engine was designed to have a 10-yr model life. Now, it is desirable to reduce that model life to four years, in order to remain competitive and to take advantage of fast-moving technology. On the other hand, production lines have become much more expensive and rigidized. The in-line machine is the common denominator for production of many parts, from blocks to manifolds. As now built, such machines are virtually scrap when and if an important product-design change is approved.

The mass producer is therefore hamstrung by the very equipment that has made it possible for him to manufacture at a satisfactory price under today's conditions. Either he holds off a desirable product change and loses his market, or he scraps many millions of dollars worth of equipment, which is obsolete only because of a product change, and raises prices. Either course looks like economic suicide. The only way out is to put more flexibility into in-line machines and other special machine tools.

Two phases of cooperative effort will be required to achieve true flexibility in in-line transfer and indexing machine tools. These are: (1) unitization or sectionalization, so major pieces of a machine can be rearranged as desired and (2) standardization of physical dimensions of units so they will fit where desired, and one make can be substituted for another. Then, as with electric motors, the user could take one off here and put it there, or stock spares to suit his needs.

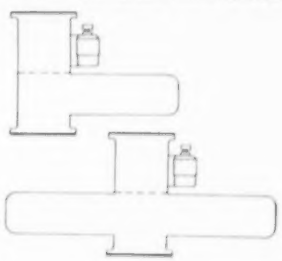
The first phase is easier to accomplish because it is possible to work with one builder toward that end. Ford has already ordered an in-line machine for manifolds (see layout). The sectionalized construction will permit far easier rearrangement if the product is modified extensively. However, the units will be standard only with that builder.

General Specifications for Interchangeable Components of Automatic In-Line Transfer Machines

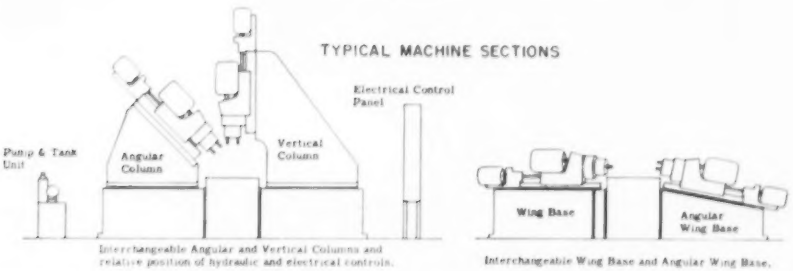


INDEX AND ROLL-OVER STATIONS

TYPICAL INTEGRAL MAIN BASES



TYPICAL MACHINE SECTIONS


Pump & Tank Unit
Angular Column
Vertical Column
Electrical Control Panel
Interchangeable Angular and Vertical Columns and relative position of hydraulic and electrical controls.
Wing Base
Angular Wing Base
Interchangeable Wing Base and Angular Wing Base.

INTERCHANGEABLE COMPONENTS of in-line transfer machine must possess uniform mounting patterns. Bold lines indicate interchangeability patterns. Definitions are:

AUTOMATIC IN-LINE TRANSFER MACHINE—A complete machine known as the Automatic In-Line Transfer Machine will be made up of Machine Sections as shown in the above layout. Transfer bar sections should be joined as a unit and actuated by a mechanical or hydraulic power unit, as applicable.

MACHINE SECTION—Each Machine Section should consist of an interchangeable Main Base which in turn consists of an idle and a work station/s, an interchangeable transfer bar section and interchangeable Wing Base/s on which are mounted interchangeable components to suit the operation/s to be performed. Transfer bars should be adaptable for operation of rollover or index stations.

The Machine Section should be independent of other Machine Sections of the Automatic In-Line Transfer Machine. It should be provided with its own electrical control panel and mechanical or hydraulic control system. Consideration should be given to completely mechanized Machine Sections.

Note: Load and unload work height, on all machines for a particular part, should be uniform and should allow for adequate chip disposal systems.
Vendor to be furnished daily production requirements pertaining to specified part/s to be manufactured during a 16 hour day. Vendor to quote the 100% capacity of each machine and the total number of machines proposed to ensure the required number of parts that must be produced in 16 hours.

The **INTEGRAL MAIN BASE** is permissible in instances where considerable rigidity is necessary because of extreme accuracy requirements. In such instances the Integral Main Base should possess mounting patterns that permit the attachment and mounting of interchangeable components as indicated, "TYPICAL INTEGRAL MAIN BASES", above.

The **WING BASE and ANGULAR WING BASE** should possess mounting patterns that permit attachment to any main base. In addition the Wing Base mounting pattern should permit the interchange of other angular and vertical columns.

The **VERTICAL and ANGULAR COLUMNS** should possess mounting patterns that permit an interchange with other Wing Bases.

The **FILLER BLOCKS** should possess mounting patterns used for Wing Bases and Main Base.

The **MAIN BASE**, consisting of an idle and a work station/s, should possess mounting patterns that permit the addition and/or interchange of other Main Bases and the attachment of interchangeable Wing Bases. The design of the idle station is optional. It can be integral with the work station; or, it can consist of interchangeable connectors such as tie blocks, tie rails and the like.

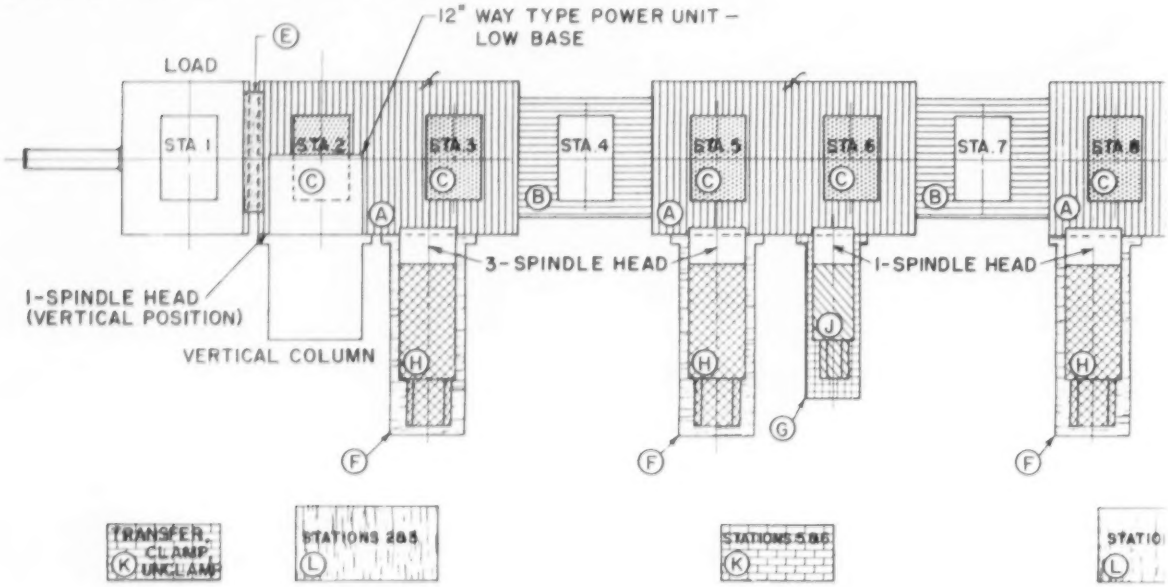
STATIONS such as "index", "roll-over", "rotate", etc., should possess interchangeable mounting patterns that permit the addition and interchange of other Main Bases.

Phase two will probably take years to accomplish, but in the end it should prove to be the more important. For example, a drillhead, or power unit, for transfer machines as now built by 10 makers has a certain critical dimension that varies all the way from 14⅞ to 41 in. If these critical and mounting dimensions could be standardized, the problem of delivery would be made easier. Supplier A might be overloaded with work, but Supplier B could take the order for an additional head when, for example, the engineers call for an additional hole in the part. Or the user could take a spare head from stock or remove one from an idle station on some other machine. *PLEASE TURN PAGE . . .* ▶

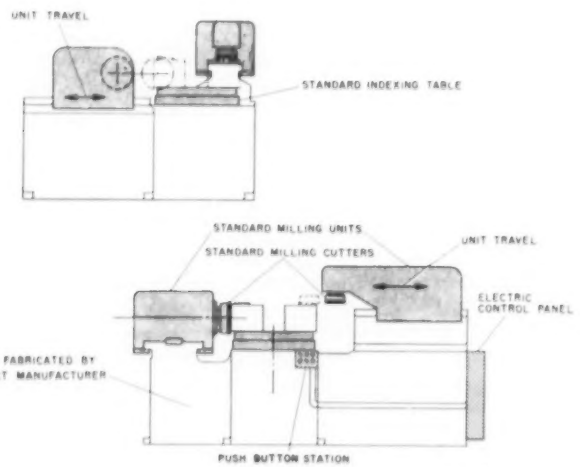
"Let's have 'building-block' machine tools" . . .

INTERCHANGEABLE UNITS AND COMPONENTS

- (A) TWO-STATION SECTIONS—MAIN BASE
- (B) IDLE STATIONS
- (C) FIXTURES
- (D) FIXTURES
- (E) TIE BLOCKS
- (F) WING BASE—10" WAY TYPE UNIT
- (G) WING BASE—6" WAY TYPE UNIT
- (H) 10" WAY TYPE HYDRAULIC POWER FEED UNITS
- (J) 6" WAY TYPE HYDRAULIC POWER FEED UNITS
- (K) PUMP AND TANK UNITS
- (L) PUMP AND TANK UNITS



Feed Type Milling Units



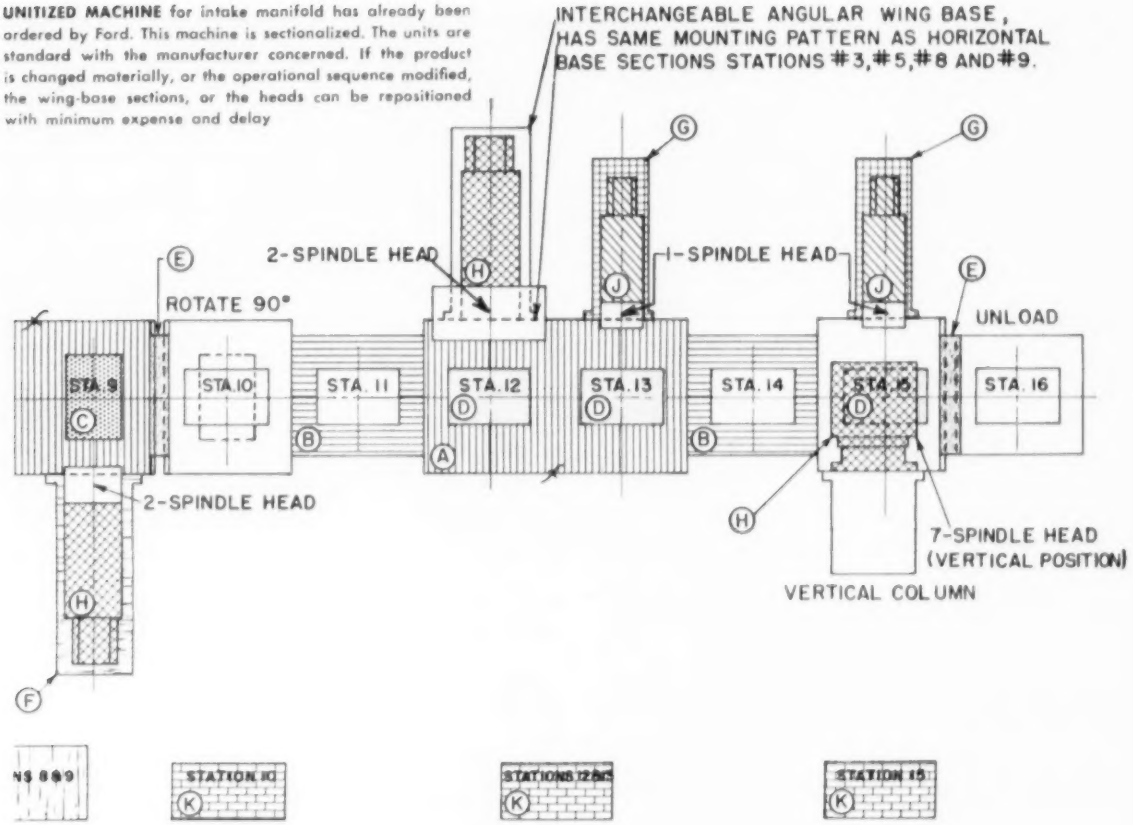
SPECIAL MACHINE TOOLS for defense work require long lead time and a high percentage of design effort. To avoid delays before or after M day, Ford suggests standardizing drilling, boring, milling and grinding units, so that they can be rush produced, even stockpiled, and built up into wanted machines by the user or local facilities. In other words, the user would proportion the base to suit his particular needs, and mount the standard units. Hence, the capacity and capability of each builder could be utilized to the maximum practical extent.

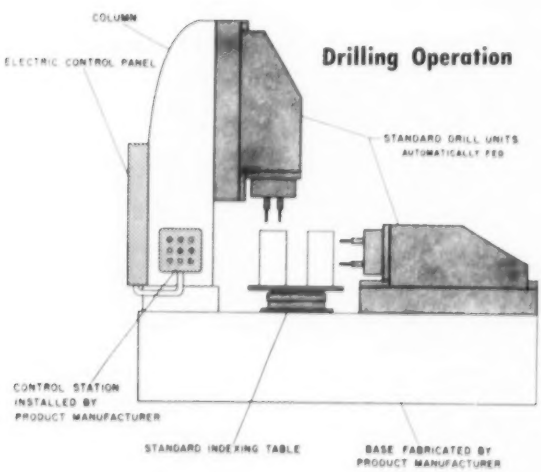
Unitized machine tools built up of standard components will be easier to set up. Each station will be a machine in itself, complete with its own electrical and hydraulic circuits. Hence, any given station can be cycled for setup purposes. Therefore, more setup people can be used on an in-line machine at a time, to put it into full production sooner.

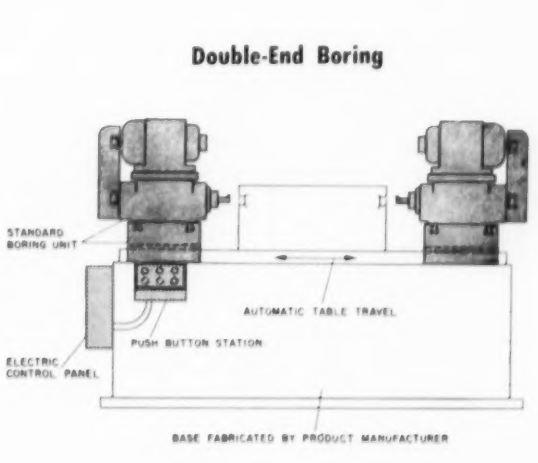
If an operation must be added on a part, it won't be necessary to provide equipment for an "off-line" operation. Instead, the in-line machine will be pulled apart, the proper machine units inserted, and production resumed.

Unitized equipment may cost somewhat more than at present, but the extra flexibility will be worth the expense. It is not improbable that even a product life of four years will prove too much

UNITIZED MACHINE for intake manifold has already been ordered by Ford. This machine is sectionalized. The units are standard with the manufacturer concerned. If the product is changed materially, or the operational sequence modified, the wing-base sections, or the heads can be repositioned with minimum expense and delay





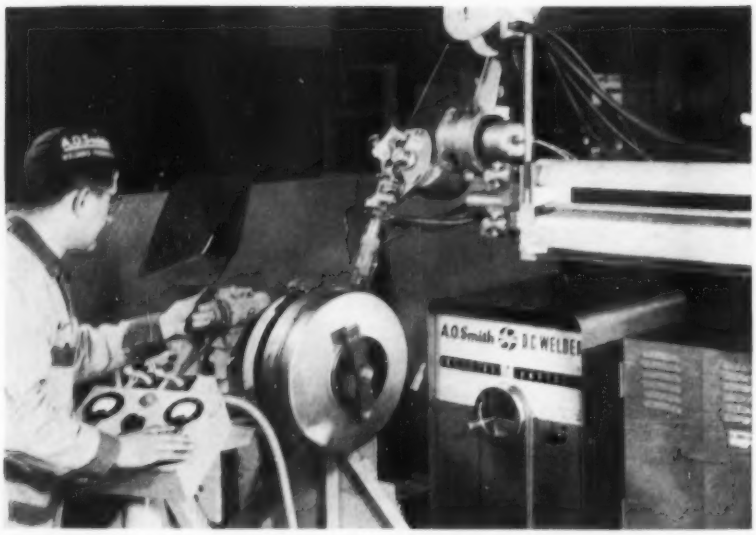


under future competitive conditions, and two years may be a more likely period.

Machine-tool builders have shown keen interest in Ford's ideas, it is said. After all, the standardized unit does have advantages to both maker and buyer. In slack times, the builder can manufacture for stock. And if the utility of the in-line or index type of machine is broadened by making it flexible to change, there will be more customers. So, a few years hence, we may find a much wider use of in-line machines.

What Do Builders Think?

Not everybody believes that the "building block" machine is the answer to cutting obsolescence costs. Turn to page 168 for a limited opinion survey among machine tool builders about Ford's proposal.



PRODUCTION OPERATIONS with CO_2 shielding require adequate and reliable power supply, automatic head, gas supply nozzle, and electric control unit, all similar to those used with the conventional inert-gas-shielded process

CARBON DIOXIDE
Slashed our welding costs

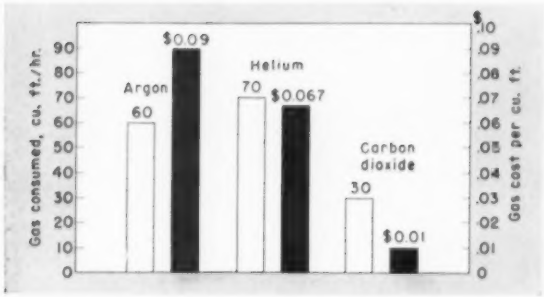
Higher speeds, clean, sound welds of top quality, and gas cost only a small fraction of that for argon or helium are features that will make it worth your while to investigate this latest technique

MADE UNDER IDENTICAL CONDITIONS as to material, amperage, voltage, wire, and speed, the weld (left) was made without CO_2. Note the deceptively smooth exterior and extreme inside porosity. The weld (right) was made with CO_2 shielding and shows excellent penetration and soundness

R. J. KELLER, asst director of welding research,
and
J. P. KOSS, supervisor,
WELDING RESEARCH LABORATORY
A. O. SMITH CORP., MILWAUKEE

Already well out of the laboratory stage, inert-gas-shielded arc welding with CO_2 as the shielding gas is now an established production process at our plant. First indications of the cost reduction achieved were so amazing that a test program was started to establish an accurate comparison. All tests were made under shop conditions, using actual production jobs and standard equipment. Gas was supplied from standard cylinders purchased in considerable quantities, but it is anticipated that costs for CO_2 can be reduced about 50% by buying in bulk tanks now commercially available. The evidence presented below is overwhelmingly in favor of the new process, but this does not mean that it is a cure-all for all welding problems, nor that it is the one best method for every job.

Certain conditions must be met. Design of the welding head and nozzle are important. The head



COMPARATIVE GAS CONSUMPTION and costs of various arc-shielding gases shows clearly the advantage of CO_2. Costs may be even further reduced by buying CO_2 in bulk tanks at about ½¢ per cu ft

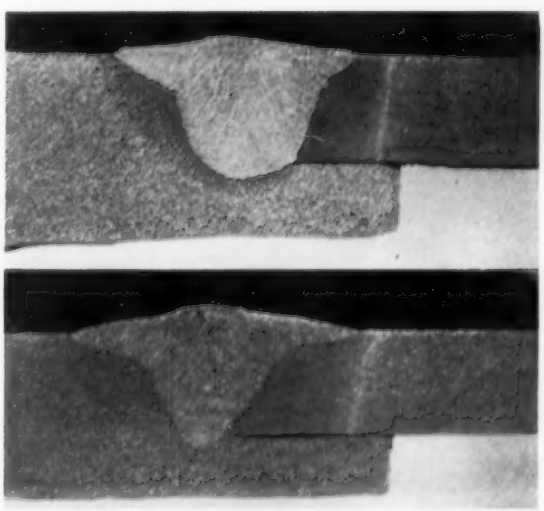
	Helium	Carbon dioxide	Savings per head
1. Gas consumption cu ft hr	70	30	40
2. Cost of gas per cu ft	$0.067	$0.01	$0.057
3. Cost of gas per hour	4.69	0.30	4.39
4. Cost per hour (60% duty cycle)	2.81	0.18	2.63
5. Cost per day (3 shifts - 22.5 hr).	63.20	4.05	59.15
6. Cost per year (260 days - 3 shifts/day)	$16,420.00	$1,053.00	$15,367.00

ANNUAL SAVINGS realized on a typical mild steel welding job amount to over $15,000 when using CO_2 instead of helium

PHYSICAL COMPARISONS of high-speed lap welds made with helium and CO_2 shielding gases show no appreciable difference in ductility, tensile, or appearance. Choice rests entirely on the major difference in gas costs

		Co_2	Argon
Type wire		1/16" sl. killed	1/16" sl. killed
Amperes		425	400
Volts		30	24
Travel speed		22"/min.	22"/min.
	Sigma argon	Carbon dioxide	Savings per head
1. Gas consumption cu ft hr	60	30	30
2. Cost of gas per cu ft	$0.09	$0.01	$0.08
3. Cost of gas per hour	5.40	0.30	5.10
4. Cost per hour (50% duty cycle)	2.70	0.15	2.55
5. Cost per day (3 shift - 22.5 hr)	60.80	3.38	57.42
6. Cost per year (260 days - 3 shifts/day)	$15,780.00	$878.00	$14,902.00

COMPARATIVE COSTS and welding conditions for welding killed steel forging to semi-killed steel shell ¼ in. thick by sigma argon and CO_2 welding. Joint requirements were for 100% penetration, Class 1 ASME Boiler Code radiographic standards, and subject to magnetic particle inspection. Minimum yield strength of weld metal was to be 70,000 psi



WELD PENETRATION with iron powder electrode (top) cannot compare with that obtained with CO_2 shielded arc. Surface appearance of the latter is smooth and free from slag, but lacks the conventional rippled appearance associated with iron-powder electrodes

PLEASE TURN PAGE ▶

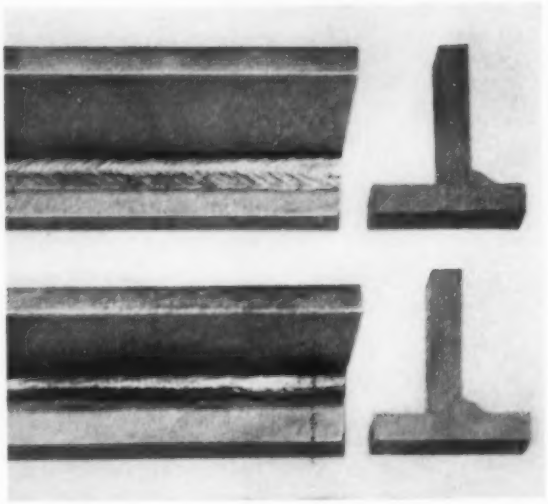
CARBON DIOXIDE . . .

must provide wire feed at high rates of feed, with good control of the arc, and the nozzle must be designed to furnish proper shielding of the molten puddle to insure high-quality welds. Good fitup and proper fixturing are essential, although this is no more critical than with other automatic-welding processes. For killed or semi-killed steels, many commercially available wires developed for inert-gas-shielded arc welding are satisfactory, but for rimmed steels it may be necessary to adjust the wire composition to obtain sound welds. As with other automatic processes, success depends to a great extent upon the welding procedure; once this has been established to produce the desired quality, it must be rigidly enforced to give satisfactory production results. In general, high current densities are required, and may vary between 100,000 and 200,000 amp per sq in. Fillet size is a limiting factor, and welds made in the horizontal position over ¼ in. tend to slump, causing unequal leg lengths. For fillets larger than ¼ in., the work should be positioned for a downhand fillet.

All production applications in our plant are being made with a single pass in the downhand position; and for high-speed work on light-gage material, it is sometimes an advantage to weld slightly downhill. We are now investigating multi-pass welding on heavier-gage materials and the results are encouraging. Double-pass welds on ⅝-in. medium-carbon steel show mechanical properties to be satisfactory for strength and ductility, and low-alloy high-tensile steels to ⅜ in. show definite promise. This work is still in the laboratory stage, but indications are that multi-pass welding with spaced V-grooves will necessitate keeping the root gap to a minimum, and that wire composition must be carefully selected to suit the steel being welded.

	Submerged arc	Carbon dioxide
1. Gas cost	–	$0.03
2. Flux cost	$0.525 (5.56 lb at $0.0945/lb)	–
3. Wire cost	$0.555 (4.45 lb at $0.125/lb)	$0.96 (3.84 lb at $0.25/lb)
4. Time / 100 A weld	13 min	12 min
5. Total cost of material	$1.08	$0.99

EVEN AGAINST SUBMERGED-ARC WELDING, the CO_2 process may show some cost advantage, as in this case, but each application requires careful study. Important advantage, however, is absence of abrasive flux and slag which wears fixtures, and requires time-consuming removal from work



PENETRATION OBTAINED with CO_2 (top) and argon (bottom). Note the broad, well-rounded penetration obtained with CO_2 which provides less danger of missing the root by misalignment of the wire and also permits gas to rise to the surface more easily, reducing chances of porosity

	Iron powder	Carbon dioxide
1. Cost of electrodes or filler wire	$3.55	$3.75
2. Gas cost	–	$0.28
3. Time required for 100 ft weld	3 hr 5 min	2 hr
4. Labor at $2.20/hr	$6.78	$4.40
5. Plus burden (100%)	$6.78	$4.40
6. Total cost	$17.11	$12.83

COST SAVINGS over the use of iron powder electrodes are equally significant. Welding speed is the major factor here. Figures are based on 100 ft of ¼-in. downhand fillet weld, with 50% duty cycle, and labor and burden rates are probably conservative

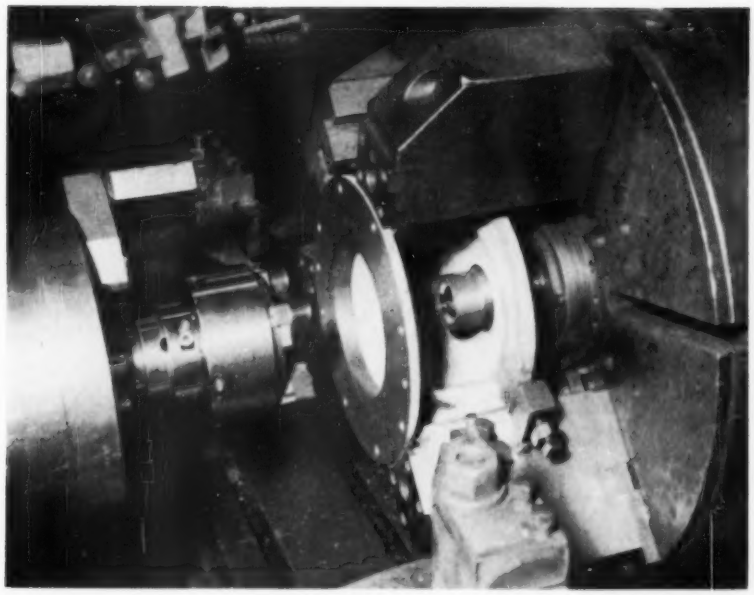
.505" DIA. SPECIMENS

Wire type	Yield strength psi	Tensile strength psi	% elong in 2"	% red of area	Remarks
A	62,600	85,250	18.5	38.9	Silky, flake
	70,800	83,850	23.5	46.5	Silky, flake
B	64,800	81,850	27.5	57.4	Cup & cone, silky
	65,400	82,700	27.5	58.3	3/4 cup & cone, silky
C	82,900	93,150	19.0	34.5	Silky, flake
	81,500	93,300	17.0	29.1	Silky, flake

HOUNSFIELD NO. 12 SPECIMENS

Wire type	Yield strength psi	Tensile strength psi	% elong in .632"	% red of area	Remarks
A	69,660	96,090	21.0	40.0	Shear, silky
B	62,635	88,270	25.0	37.0	1/2 cup & cone, silky

ALL-WELD-METAL TENSILE TESTS prepared from multi-pass welds, using three different types of wire, show that the quality is equal to that obtained with the various types of coated electrodes

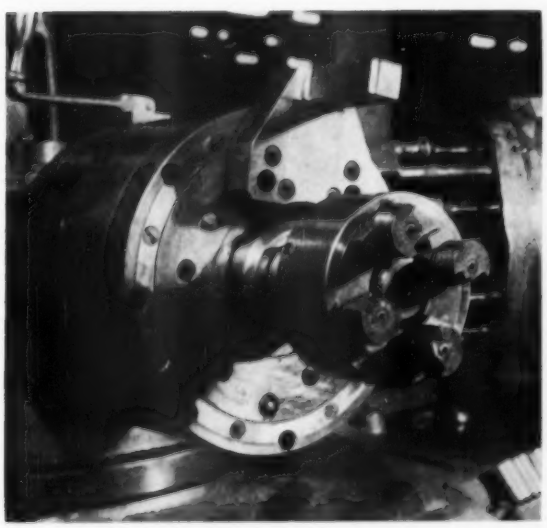


WORK IS A CAST-STEEL WATER-PUMP BRACKET, chucked in a model 6 DREL Potter & Johnston automatic turret lathe. Chasing attachment (left) is on one face of turret. Driving arm (left) is attached to attachment housing, and engages drive bracket bolted to face of chuck. Thus, headstock rotates diehead housing in same direction and at same speed as chuck

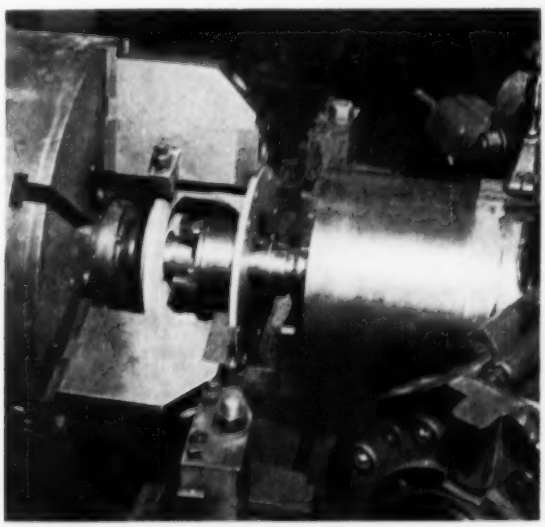
One way to chase left-hand threads in a non-reversing lathe

ROBERT C GREER
supervisor of tool design
CATERPILLAR TRACTOR CO
PEORIA, ILL

If you can't make the work rotate backwards, how are you going to cut a left-hand thread? This method uses a smallish turret attachment that speeds up to chase the work in more ways than one



CHASER IS A NATIONAL ACME 2-IN.—12 DIEHEAD, arranged for internal tripping and self-opening. Outside housing rotates as driver arm follows lathe chuck; 8-in. internal gear inside it also rotates; planetary arrangement with two 2-in. gears and central 4-in. gear on diehead spindle makes diehead rotate twice as fast as chucked work

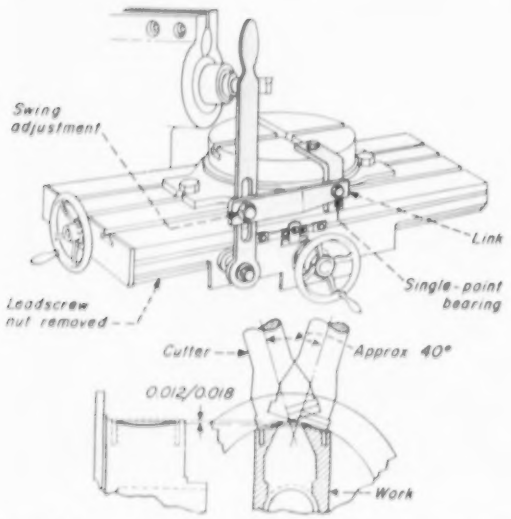


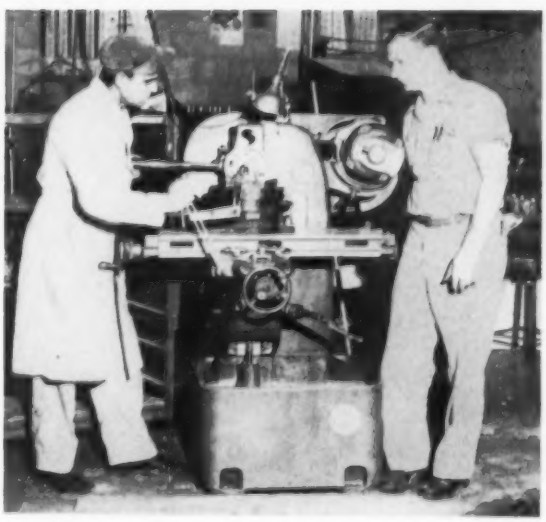
ATTACHMENT CUTS LEFT-HAND THREAD TO DEPTH, then retracts. Note driver arm directly under work, engaged with chuck bracket. Next turret face has 10-spindle drilling attachment driven from chuck by same bracket-arm method. Gears inside attachment are of AISI 2345 steel, hardened and ground; so are diehead spindle and reset plunger. Diehead spindle may be adjusted in or out to thread other pump brackets of different size

Mobile heat-treat furnace . . .

moves itself along rails that straddle loading pit, heating area, quench tanks, and carburizing furnace. Unit has pre-set automatic cycle including choice of different atmospheres and various sequences for complete heat-treatment. Furnace takes stock up to 16x4-ft capacity, loaded and unloaded from pit under rails. *California-Doran Heat Treat Co, Los Angeles*

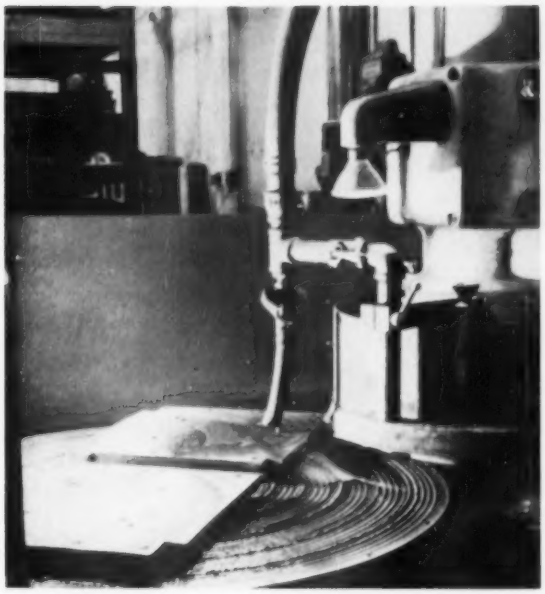
SHOP SHOTS





Double motion makes miller cut curves . . .

in rotary choke for waveguide rotary switch. Cylindrical edge of work has to be cut to produce a curved surface 0.011 in. below the OD contour (see sketch). Leverage attached to Nichols hand miller rotates Hardinge super-spacer as table is traversed. This makes the work shift as it rotates past the cutter, producing the cut required. New setup does job in 1/7 the time formerly required, and turns up better surface finish. *Dalmo Victor Co, San Carlos, Calif*



Grinder finishes plates . . .

within 0.001 in. parallel to make them carry differential-carrier castings in alignment on auto machining line. Each plate has four pads on lower surface; these are ground first, then tops are finished. Operation takes 1½ hr, with wheel speed of 710 rpm, to remove about ⅛ in. of metal. Machine is a Mattison with 48-in. table. *Cross Co, Detroit*

Powered electronic gage . . .

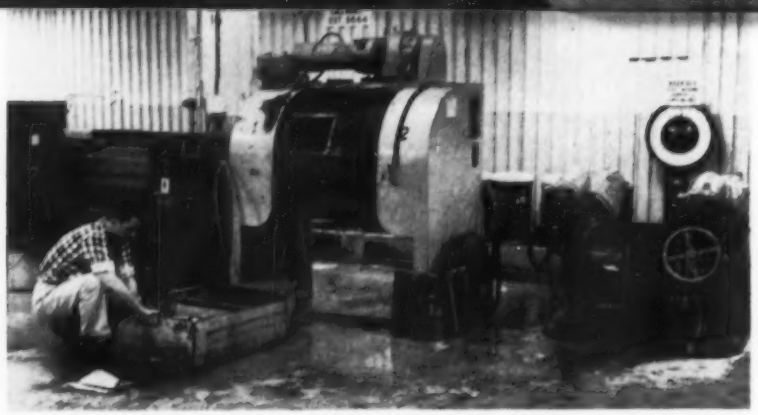
checks three tapers inside barrel of 20-mm machine gun. While operator uses conventional snap-gage indicator on OD, two opposing gaging tips are moved into barrel by motor-driven platform. Tip movements are recorded continuously in increments of 0.0001 in. on paper tape; five datum diameters are later checked on record to allow OK of part. *E W Bliss Co, Canton, O*

Burrless holes are drilled . . .

in fire-extinguisher lines by Elox model M 300. Tubes from ⅜ to 1 in. in dia, up to 6 ft long, will go into aircraft extinguisher systems, for routing CO_2. Exit holes must be burrless to prevent jamming. *Douglas Aircraft Co, Santa Monica, Calif.*

Wood fixtures . . .

speed wiring assembly 25%. Safety wire and screws are added to assemblies held in tool with T-handle, which is inserted in wooden receptacle. This can be rotated and indexed to shift work for operator's convenience; held by thumbscrew. *Martin Aircraft Co, Baltimore*



A well-equipped tumbling department at the Martin Plant II, Baltimore, Md, includes an 18-cu-ft, two-compartment barrel; a 13-cu-ft single-compartment barrel; a 5-cu-ft, two-compartment barrel; a ½-cu-ft, single-compartment barrel; two 1 1/3-cu-ft conical barrels. Other barrels are also in use

Examples of "before and after" barrel-finished parts of different materials

It's cheaper by tumbling

Cost per part tumbled has fallen from 10¢ to less than ¾¢, as experience has been gained and more diversified equipment installed. Process sheets have been developed to judge whether various parts are suitable for tumbling

LEON E LAUX, supervisor, Manufacturing Research & Development, GLENN L MARTIN CO, BALTIMORE

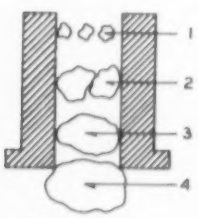


FIGURE 1

Fig 1—Selection of media size with respect to a slot. Sizes 1 and 4 are correct; sizes 2 and 3 are not because these chips are able to enter the opening and lodge there

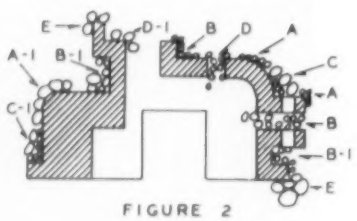


FIGURE 2

Fig 2—Areas *A* and *A*-1 show the difference in number of contact points obtained from small and large media. Areas *B* and *B*-1 show how smaller media will reach further into recessed corners than large. Areas *C* and *C*-1 show how less recessed (except inside corners) may be reached by both large and small media. Areas *D and D*-1 explain why the larger media have a more pronounced effect on corners and other protrusions. Areas *E* depict a burr being removed

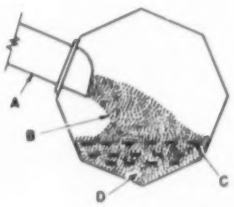


FIGURE 3

Fig 3—Loading procedure: *A*—lift pan supplying media; *B*—flow of media to cover parts, *C*—layers of parts; *D*—heavily builtup area on bottom layer

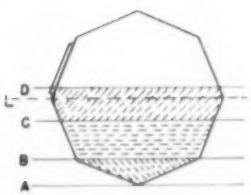


FIGURE 4

Fig 4—Water levels are based on 50% barrel load, indicated by dotted line marked *L*. Water level *A* to *B* is used for fast deburring. Water level *A* to *C* is used for honing and some deburring operations. Water level *A* to *D* is used for burnishing. The effect of a higher water level is to soften the fall of parts in the barrel, which reduces the probability of nicking

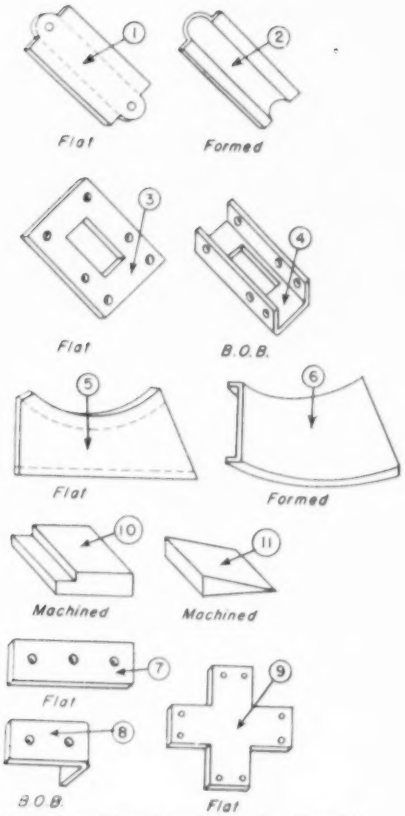


TABLE I—Barrel Loading for Tumbling

Size of Part cu in.	Maximum Loading, Pieces	Size of Barrel
2	900	
3	600	
4	450	
6	300	
12	150	
18	100	Large
24	75	
30	60	
36	49	
48	37	
6	100	
9	65	
12	50	
18	35	Small
24	25	
30	20	
36	15	
48	12	

FERROUS & NON-FERROUS METAL SHEET STOCK

No.	Material (All Alloys)	Minimum Wall Thick*	Maximum Size	Typical Prior Operation	Burr Method Sequence 1†	2	Typical Next Operation
	Alum	0.032	1×3×4		File		
1	Mag.	0.032	1×3×4	Saw	Scrape	Tumble	Form
	Copper	0.032	1×3×4	or	or		or
	Steel	0.032	1×3×4	Shear	Sand		B.O.B.
	Alum	0.040	1×3×4		File		
2	Mag	0.040	1×3×4	Saw	Scrape	Tumble	Form
	Copper	0.040	1×3×4	or	or		or
	Steel	0.040	1×3×4	Shear	Sand		B.O.B.
	Alum	0.051	1×3×6		File		
3	Mag	0.051	1×3×6	Saw	Scrape	Tumble	Form
	Copper	0.051	1×3×6	or	or		or
	Steel	0.051	1×3×8	Shear	Sand		B.O.B.
	Alum	0.063	1×3×8		File		
4	Mag	0.063	1×3×8	Saw	Scrape	Tumble	Form
	Copper	0.063	1×3×8	or	or		or
	Steel	0.063	½×3×8	Shear	Sand		B.O.B.
	Alum	0.072	½×3×8		File		
5	Mag	0.072	½×3×8	Saw	Scrape	Tumble	Form
	Copper	0.072	½×3×8	or	or		or
	Steel	0.072	¼×4×8	Shear	Sand		B.O.B.
	Alum	0.091	¼×3×8		File		
6	Mag	0.091	½×3×8	Saw	Scrape	Tumble	Form
	Copper	0.091	½×3×8	or	or		or
	Steel	0.091	¼×4×8	Shear	Sand		B.O.B.
	Alum	0.102	½×3×8		File		
7	Mag	0.102	½×3×8	Saw	Scrape	Tumble	Form
	Copper	0.102	½×4×8	or	or		or
	Steel	0.102	¼×4×8	Shear	Sand		B.O.B.
	Alum	0.125	½×3×8		File		
8	Mag	0.125	½×3×8	Saw	Scrape	Tumble	Form
	Copper	0.125	½×4×6	or	or		or
	Steel	0.125	¼×4×8	Shear	Sand	↓	B.O.B.
	Alum	0.250	½×3×8		File		
9	Mag	0.250	½×3×8	Saw	Scrape	Tumble	Form
	Copper	0.250	½×4×6	or	or		or
	Steel	0.250	½×4×8	Shear	Sand		B.O.B.
	Alum	0.750	½×3×8		File		
10	Mag	0.750	½×3×8	Saw	Scrape	Tumble	Machine
	Copper	0.750	½×4×6	or	or		
	Steel	0.750	¼×4×8	Shear	Sand		
	Alum	1.00	½×3×8		File		
11	Mag	1.00	½×3×8	Saw	Scrape	Tumble	Machine
	Copper	1.00	½×4×6	or	or		
	Steel	1.00	¼×4×8	Shear	Sand		

* Minimum permissible wall thickness of holes or slots over ½ in.
† Operation No. 1 performed only when burrs on detail are heavier than 0.010 in., and as a "prepare for barrel finishing" operation

Within two years, our Baltimore plant has increased the use of barrel tumbling from 1,000 to 30,000 pc per week and a further increase is expected. Once we could tumble only small parts. Today, we tumble everything from tiny clips and filler blocks to complex forgings weighing 10 or 12 lb. Probably more than 1,000 different types of airplane parts are now being descaled, deburred or finished by this process. Rejects are low—only 0.2%.

Tumbling has been profitable to us. Our first large barrel (13 cu ft) is estimated to have saved $18,500 during the first year of operation.

Let's look at a few more figures: A current contract for P5M's involves approximately 28,200 details per ship. Of these, approximately 20,000 details are suitable for tumbling. Savings over previous hand methods of deburring and finishing average $238 per ship. This saving amounts to a substantial figure for the balance of the contract.

COSTS DECLINE AS PRODUCTION GOES UP

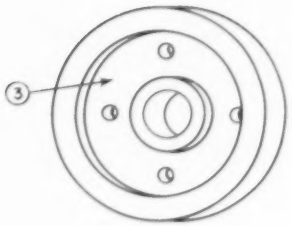
During our initial development period, which began in January '54, operational costs for barrel finishing were around 10¢ per detail—40% above break-even costs for manual deburring. Break-even point of 6¢ per detail was reached by mid-August,

It's cheaper by tumbling . . . continued

FERROUS & NON-FERROUS CASTINGS & FORGINGS

No.	Material (All Alloys)	Min. Thickness Webs & Flanges	Maximum Size	Minimum Wall Thick*	Typical Prior Operation	Burr Method Sequence 1†	2
1	Alum Mag Copper Steel	0.32 thru 0.051	1×2×2 1×2×2 1×2×2 1×2×2	1 1 1 1	Machine & Drill	File Scrape or Sand	Tumble
2	Alum Mag Copper Steel	0.063 0.063 0.063 0.063	2×2×3 2×2×3 2×2×3 2×2×3	1 1 1 1/2	Machine & Drill	File Scrape or Sand	Tumble
3	Alum Mag Copper Steel	0.072 0.072 0.072 0.072	3×3×3 3×3×3 3×3×3 3×3×4	1/2 1/2 1/2 1/4	Machine & Drill	File Scrape or Sand	Tumble
4	Alum Mag Copper Steel	0.091 0.091 0.091 0.091	3×3×3 3×3×3 3×3×3 3×3×4	1/2 1/2 1/2 1/4	Machine & Drill	File Scrape or Sand	Tumble
5	Alum Mag Copper Steel	0.125 and up	3×3×8 3×3×8 3×3×8 4×4×8	1/4 1/4 1/4 1/4	Machine & Drill	File Scrape or Sand	Tumble

* Minimum permissible wall thickness of holes or slots over ½ in.
† Operation No. 1 performed only when burrs on detail are heavier than 0.010 in. and as a "prepare for barrel finishing" operation



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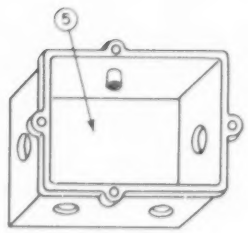

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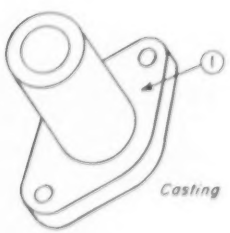

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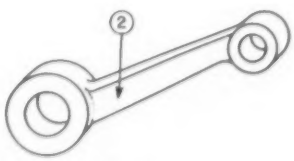
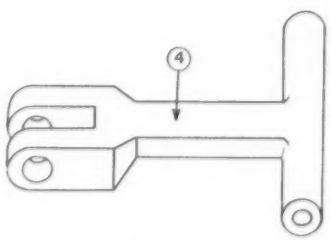


Forging



Forging

and we continued at that level until October. By the end of 1954, average over-all cost had fallen to 1¢ per detail.

We were not content. A study by our Standards-Methods Department showed that tumbling could be used even more extensively. Spurred by this fact, we succeeded in bringing the cost down to ¾¢ per detail during 1955.

WHAT DO WE TUMBLE?

About 95% of the parts tumbled are aluminum alloys. Originally, we were limited to small stamped parts. Now we handle stampings, forgings, machined forgings, castings, formed parts, and extrusions with equal facility.

Besides aluminum, we also tumble steel, stainless steel, brass, copper, magnesium, titanium, and even plastic parts.

We have learned how to tumble different parts in the same run. This is one of the reasons why our costs have fallen. A full load for the tumbling barrel saves both manhours and machine time, as well as tumbling compounds and abrasives. However, it is not often possible for us to load a large barrel with identical parts. Aircraft production involves small lots of thousands of different parts. We had to learn how to adapt the tumbling process to that condition.

Most of our tumbling is done to remove burrs, using fused aluminum-oxide chips, tumbling compound, and water.

The purpose of deburring is fourfold:

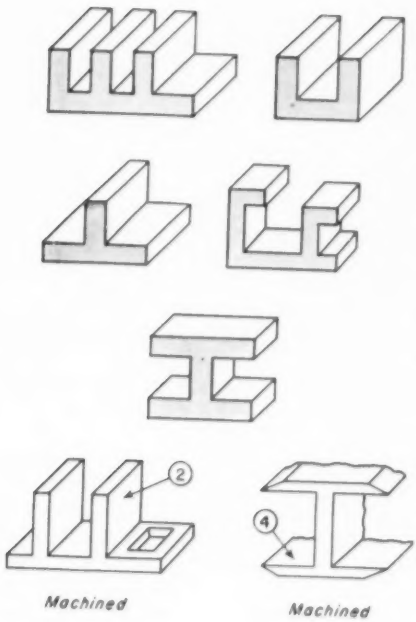
(*a*) To minimize cracking in the case of fatigue-sensitive materials that must undergo forming, such as bending on a press brake, or will be subject to critical stresses under load.

(*b*) To smooth sharp edges that could cut or damage wiring, cables, hoses, etc. Not all sharp edges are burrs, but the deburring process rounds off all the edges at the time the burrs are removed.

(*c*) To assure positive mating of assemblies—holes in splices, etc.

(*d*) To prevent injury to workers who are handling details during the process of manufacture.

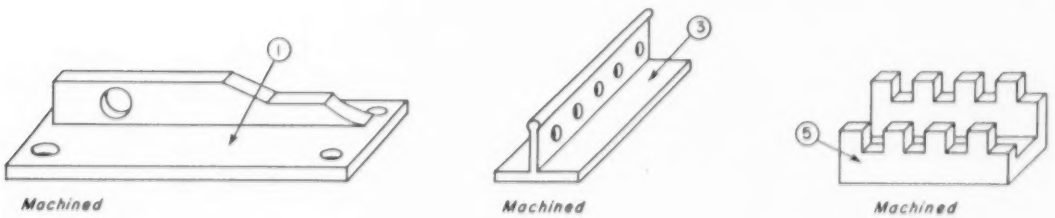
Tumbling is also done to remove scale. Specified surface conditions or "finishes" are produced in the tumbling barrel in much the same way as burrs are removed. The tumbling compound is the essential difference. Using the proper compound, we can pro-



FERROUS & NON-FERROUS EXTRUSIONS

No.	Material (All Alloys)	Min. Thickness Webs & Flanges	Maximum Size	Minimum Wall Thick*	Typical Prior Operation	Burr Method Sequence 1†	2
1	Alum Mag Copper Steel	0.032 thru 0.051	1×2×2 1×2×2 1×2×2 1×2×2	1 1 1 1	Machine	File Scrape or Sand	Tumble
2	Alum Mag Copper Steel	0.063 0.063 0.063 0.063	2×2×3 2×2×3 2×2×3 2×2×3	1 1 1 ½	Machine	File Scrape or Sand	Tumble
3	Alum Mag Copper Steel	0.072 0.072 0.072 0.072	3×3×3 3×3×3 3×3×3 3×3×4	½ ½ ½ ¼	Machine	File Scrape or Sand	Tumble
4	Alum Mag Copper Steel	0.091 0.091 0.091 0.091	3×3×3 3×3×3 3×3×3 3×3×4	½ ¼ ½ ¼	Machine	File Scrape or Sand	Tumble
5	Alum Mag Copper Steel	0.125 and up	3×3×8 3×3×8 3×3×8 4×4×8	¼ ¼ ¼ ¼	Machine	File Scrape or Sand	Tumble

* Minimum permissible thickness of holes or slots over ½ in.
† Operation No. 1 performed only when burrs on detail are heavier than 0.010 in., as a "prepare for barrel finishing" operation



duce low micro-inch finishes. Our normal finish is around 60 to 125 RMS, but we can attain extremely fine finishes.

CHIPS, COMPOUNDS, EQUIPMENT

Much of our success with the tumbling barrel may be attributed to the use of precisely graded, fused aluminum-oxide chips (technically known as "media"), and tumbling compounds. In an average month, we now consume some 3,350 lb of compounds and close to 600 lb of chips, supplied by Lord Chemical Co, York, Pa.

Media sizes range from 00 (large chips of about 2 in.) down to 12 mesh, where the grains are like coarse sand. Our chips have been pretumbled during manufacture and come to us ready for service. We wash them periodically to keep them from clogging with metallic particles and to assure us that there will be no contamination when switching from one compound to another.

Chips gradually wear down and must be regraded to smaller sizes. However, they seldom fracture. Even under heavy production, chips will last for a long time.

One or more tumbling compounds are needed in each run. Details will be given later.

We plan to add more barrels as increased production warrants the investment and also to provide fixtures for tumbling large, heavy parts.

To assist us in judging whether or not a particular part is suitable for tumbling, we have prepared three process planning sheets—one for extrusions, one for castings and forgings, and one for sheet metal. These sheets tell at a glance whether or not a specific part is suitable for tumbling. Each planning sheet takes into consideration such factors as material (aluminum, magnesium, copper, steel), minimum and maximum thickness, maximum dimensions, and prior operations such as machining or drilling.

At present, there is no applicable Government specification for barrel descaling, deburring, and finishing of metal parts. Over a period of several years, in association with engineers of Lord Chemical Corp, we have prepared a manual for our tumbling operators and supervisors. Most of the information that follows is condensed from this manual.

PLEASE TURN PAGE ▶

PREPARATION FOR TUMBLING

Burrs are examined carefully before the tumbling of a part is started. Burrs up to 0.020 in. high are readily removed by short-cycle tumbling, if accessible to the media. Very heavy burrs are usually removed manually by filing, scraping, or sanding.

Another preliminary consideration is to determine the number of parts that can be safely loaded in a barrel. This may be ascertained from Table I. To use this table, the volume of each part must be computed in cubic inches. When the volume of a particular detail falls between the sizes given in this table, the maximum barrel loading must be interpolated. As an example, for 2½ cu in., the maximum loading will be 750 parts. If the estimate cannot readily be interpolated, the next lower barrel loading figure from the table is used.

When selecting media for a particular part, it is necessary to consider all recesses, radii, angles, fillets, slots, holes, and intricate contours. The rule, however, is fundamentally simple: Select the chip size that will not wedge in the work. By comparing media of different sizes with the part, Fig 1, it can be easily determined which size will be best suited for the particular part.

When the parts are in the tumbling barrel, the total weight of the mass directly above a particular piece will be transmitted to that piece by the media at their contact points. The fewer contact points there are, the more pressure will be exerted on each point, and the deeper the surface scratches. Obviously, large chips can never produce as smooth a surface as smaller ones. See Fig 2.

Example: To remove the burr from a ¼-in. radius on a soft Alclad surface, use chip size 4, from ⅜ to ⅛ in. This chip size is matched to the particular job.

SELECTING THE TUMBLING COMPOUND

Here are the compounds that we use and their purposes:

"Lorco ZA." This concentrated, non-dusting powder is probably our most heavily used compound. It is an integral part of every procedure that involves the processing of aluminum. (Magnesium is processed with a slightly different compound "Lorco ZA-2.")

"Lorco 3A and 6A." These abrasive-type compounds provide fast cutting in deburring. 6A has a coarser abrasive than 3A but is otherwise the same formula.

"Lorco 4X." This extremely fine abrasive compound is for the refining of all metallic surfaces to low micro-inch finishes.

"Lorco Hi-Brite," a blended powder compound for high luster finishing and burnishing of iron and steel.

"Lorco AR." Watery liquid for dip rinses to keep ferrous parts from rusting.

"Lorco MC-3, MC-4, and MC-5." These alkaline powder compositions clean, brighten, and inhibit rust. Slightly different in formulation, all three compounds will remove abrasive film and sludge.

"Lorco GW." This viscous liquid cleans tumbling media and tumbling barrels. It may also be used for degreasing parts preparatory to tumbling.

BASIC TUMBLING PROCEDURE

After barrel loading, chip size, and tumbling compound have been determined, the basic tumbling procedure can be outlined in twelve simple steps:

1. Load parts and chips. Proper method of loading the barrel is shown by Fig 3. Heavy and precision parts are loaded in layers. Light and non-precision parts can be loaded in the barrel on top of the media. In both cases, there should be a heavily built-up bottom layer of media.

2. Add water. Different water levels used in barrel finishing are shown in Fig 4.

3. Add tumbling compound.

4. Turn switch "on" and rotate barrel. A normal run to remove burrs from aluminum and magnesium parts is 30 min to 3 hr. To remove burrs from steel parts, a normal run is 1 to 4 hr. Barrel should be reversed periodically every ½ hr to 45 min.

5. When parts are being tumbled for the first time, inspect them frequently for nicking, marking, or rough surfaces. If corrective measures must be taken, here are seven things that may be done:

(a) Add wooden or rubber blocks to separate parts during tumbling.

(b) Reduce the ratio of parts to media.

(c) Increase volume of total parts and media load.

(d) Increase water level if nature of parts permits.

(e) Employ a suitable mixture of large and small media.

(f) Use tumbling compounds that provide a "cushioning" action on parts. This will reduce the effects of their contact with each other.

(g) Check the load until barrel speed is properly adjusted. Nominal barrel speed is 5-10 rpm; 6½ rpm for machined parts.

6. If parts are properly deburred, and this is all that the work card calls for, stop tumbling. Rinse, as necessary, and remove parts. If burnishing must be done, include operations 7, 8, 9, and 10.

7. Rinse load thoroughly.

8. Add burnishing compound and water to proper level. Media does not have to be changed nor parts removed from the barrel. The burnishing run is the same as the deburring run, except that the water level and compound are different. For aluminum and magnesium, a normal burnishing run is from 30 to 45 min; for steel, about 60 min.

9. Check condition of parts. This is done before emptying tumbling compound so that additional tumbling may be done if needed.

10. Rinse if indicated.

11. Unload media and parts; then separate.

12. Dry. In our shop, precision and heavy parts are dried by forced air. Small parts can be centrifugally dried if handled carefully.

As operators become adept, more and more parts may be shifted from hand deburring to barrel tumbling.

American Machinist
SPECIAL REPORT NUMBER 426

Titanium Today...

PRICE IS DOWN, output up, and fabricating simpler. Applications are still mostly military, and the price is still far above other structural materials; but the "queen of metals" combines tantalizing high strength per unit weight with higher resistance to heat.

Even to us, the growth of titanium technology is a bit breathtaking. Last August 15 we published a Special Report on "How to Work Titanium," and had to make additions when the data were included in "How to Work Non-Ferrous Metals" three months later.

Now we've made two spectacular finds: One is the finest series of full-color fabrication pictures we've ever seen, showing how Convair makes the shroud for the J-57 engine. The other is research by Ford's Aircraft Engine Division that vastly simplifies arc welding. They, with a lead article detailing the price change, some new alloys, and other developments, make up this further Special Report. A bibliography of *AM* articles provides background.

—*THE EDITORS*

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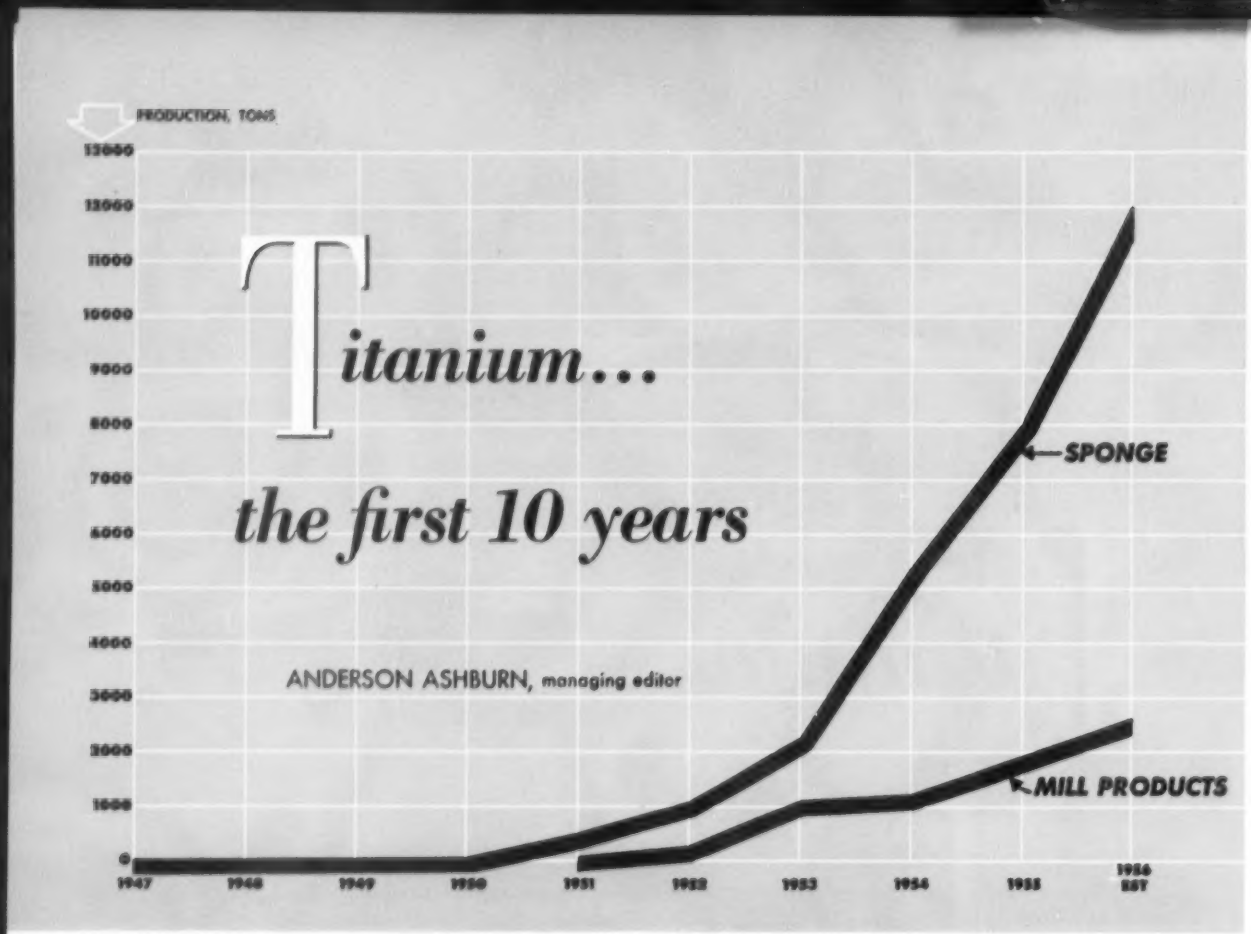

Titanium... the first 10 years

ANDERSON ASHBURN, managing editor

A decade ago the U S Bureau of Mines began pilot production of titanium sponge—the raw material from which titanium metal is made. Thus began the modern career of a metal that had been discovered a century and a half before by an Englishman, named by an Austrian (for the Greek god Titan), and extracted from its ores by a native of Luxemburg.

How far the metal has gone in the ten years since then is shown graphically in the chart above. With such merits as a high strength-weight ratio, corrosion resistance, and plentiful ores, plus the promise of high-temperature resistance, titanium seemed so essential to the supersonic era that both research and production were heavily subsidized.

Sponge was first produced commercially and the metal offered for sale in September, 1948. From the level of 3 tons that year, sponge production has grown to 8000 tons in 1955, should reach the present planned capacity level of 28,500 tons in 1958.

All of this sponge is produced by the Kroll process, or some modification of it, except at the Electro-Met plant. Operations at this plant began last April with sodium, rather than magnesium, as the reducing agent.

For several years there have been reports of a continuous reduction process. Horizons Titanium has developed an electrolytic process (though it is reported to be a batch process, too) and is building a pilot plant for it. Others have worked on the problem and there are patent applications galore, but none seems able to compete with the magnesium- and sodium-reduction methods.

Meantime, some of the early revulsion at mass production by batch methods seems to be dying out. Batch methods, as in open-hearth steel, have been known to be successful.

All expansion of sponge production was with the support of the government until last year. Last September, ODM withdrew its offer of output aid, leaving several negotiations dangling.

This year Titanium Metals decided to increase sponge production at Henderson from 3600 to 6000 tons per year without benefit of a purchase guarantee. DuPont has just announced a similar plan to raise its production from 3600 to 7200 tons per year. This is perhaps the best evidence that no electrolytic process can yet compete commercially

Titanium sponge production capacity*

Producer	Tons per Year
E I DuPont de Nemours & Co, Inc	7,200
Titanium Metals Corp of America	6,000
Dow Chemical Co	1,800
Electro Metallurgical Co	7,500
Cramet, Inc	6,000
Total	28,500

*Includes eventual capacity of plants now building. The pilot plant operated by the Bureau of Mines (the catalyst that started the whole program) has been shut down.

with the Kroll process, and at the same time that demand is still expected to increase sharply.

In addition to the companies listed as reducing or melting titanium today, a number of others have done research and development work and can be expected to figure in future expansions. Among them: New Jersey Zinc (an early producer of high-purity iodide titanium), Kennecott Copper, Anaconda Copper, Kaiser Aluminum, Bohn Aluminum & Brass, Harvey Aluminum, National Research, Monsanto, National Distillers, Eagle-Picher, and Glidden.

At first, sponge sold for $5 a lb and metal ranged up to as much as $30 a lb. The first price cut was in the spring of 1954, followed by another in the spring of 1955, a third last fall, and three more in recent months. The reduction early this month has brought sponge to $2.70 to $3.00 a lb, and metal to a range of about $7 to $15 a lb, depending on form and alloy.

Sponge not melted into metal has gone into stockpiles. Much of this sponge was stockpiled at $5 a lb. In addition, the content of hydrogen, oxygen, and carbon is probably well above the levels considered acceptable today.

What about metal?

At first the metal was in critical supply. But as sponge output rose, mill shipments of metal lagged behind. This was partly the result of loss in converting sponge to ingot (at one time the loss was about 40%), but methods for remelting the scrap from ingot scalping have been developed and the yield is now running much higher.

Most of the lag in adding melt capacity can be traced to a simple fact: lack of demand. Technical difficulties with the material, disappointment over early properties, the fact that there wasn't enough metal for even a single major production application, and the high cost all combined to make even the limited production a drug on the market by 1954.

Progress was made. Operational failures in aircraft were traced to hydrogen contamination and hydrogen was removed; difficulty with machining and forming were traced to carbon and carbon content was reduced.

Methods for working titanium are now fairly well established (see *AM*—Mid-Nov '55, p 98-107, and bibliography on next page). Under a government contract, the Titanium Metallurgical Laboratory has been established at Battelle Memorial Institute, Columbus, Ohio, to collect, evaluate, and make available to industry the information required to use titanium.

The Pratt & Whitney J-57 jet engine uses large quantities of titanium and titanium alloys. With its high thrust and light weight, this engine is powering such planes as the North American F-100, the McDonnell F-101, the Convair F-102, the Chance Vought F8U, and the Boeing B-52.

Shown on the cover of this issue is a J-57 engine in operation in a test cell. On page 133 starts a full-color story on fabrication of shrouds for the engine by Convair, and on page 141 starts a report on welding titanium based on work at Ford on the J-57.

Titanium mill products producers . . .

Mallory-Sharon Titanium Corp, Niles, Ohio
Jointly owned by P R Mallory & Co, Inc, and Sharon Steel Co

Rem-Cru Titanium Inc, Midland, Penna
Jointly owned by Remington Arms (a DuPont subsidiary) and Crucible Steel Co of America

Republic Steel Corp, Massillon, Ohio
Joint owner with Crane Co of Cramet, Inc., sponge producer

Titanium Metals Corp of America, Henderson, Nev
Jointly owned by National Lead Co and Allegheny Ludlum Steel Corp

Aircraft production orders placed late last year have resulted in a shortage of titanium again. Melting capacity is being expanded (no easy task, but far simpler than the expansion of sponge production) and mill shipments this year may run something over 2500 tons.

More than half of the demand is for alloy metal. In a study of the alloy situation, Battelle concludes that much of the difficulty with heat-treatable alloys can be traced to the presence of the interstitial elements (carbon, oxygen, nitrogen, and hydrogen). Now that double-melted vacuum metal (which is low in these interstitials) is available, there is more opportunity for alloys that can be formed in the soft condition, then heat treated with reliable results. This is already being done with the 6% aluminum-4% vanadium alloy.

More use is anticipated of the all-alpha aluminum-tin alloys which offer considerable leeway in composition and properties. In the alpha-beta alloys, Battelle anticipates more use of stabilizing elements such as molybdenum and vanadium together with aluminum and tin.

Along with their efforts to increase supplies of the metal, suppliers are seeking to develop non-defense applications. Industrial customers are protected by Dept of Commerce order M-80, which allows 10% of output to go to non-defense uses. It is doubtful if present industrial demand is more than 2 or 3% of the supply.

Development in working titanium

Titanium castings are still not really practical. The metal must be vacuum cast to avoid contamination by the interstitials. It has been cast experimentally and work is now underway on a horizontal casting machine to reduce the height required with a vacuum furnace above a casting chamber. *(Next page, please)*

Titanium timetable . . .

1790 . . Rev William Gregor identified the element
1795 . . Klaproth named the element for Titan
1910 . . Hunter produced first sample of relatively pure titanium by reducing the tetrachloride with sodium
1937 . . Dr William Kroll developed magnesium reduction process
1946 . . U S Bureau of Mines began pilot production of sponge by the Kroll process
1948 . . DuPont began pilot production, offered metal for sale
1950 . . Titanium Metals Corp and Rem-Cru Titanium formed
1953 . . Double-melt Process developed at Armour Research Foundation
1954 . . Hydrogen contamination discovered and corrected
1955 . . First large aircraft contracts involving titanium
1956 . . First expansion of sponge production without government purchase support

Forgings are generally available (see bibliography) and more recently limited quantities of extrusions have appeared. Harvey Aluminum has recently installed melting facilities for conversion of sponge through ingot to forgings and extrusions.

Sheet and plate have been formed and bent by many companies, generally at elevated temperatures. More recently, experience has been gained in drawing. For example, Brooks & Perkins have drawn both commercially pure and alloy titanium. Temperatures range as high as 900 to 1100 F for the newer alloys.

In 1954, Brooks & Perkins drew a 3-in.-dia cup to a 5-in. depth in the 55,000 yield strength material. They believe that deeper draws are possible, but have not had occasion to test them.

Principal problems in deep-drawing alloy titanium will center on methods of working the metal at the high temperature required and in finding tools and lubricants that will stand up at these temperatures. Most frequent success has been reported with colloidal graphite as lubricant. Molybdenum disulfide and phosphate coatings are preferred by some. Carbide dies are reported to cause less difficulty with galling than other types and also have the desired temperature resistance.

Cooking kettles have been deep drawn experimentally by another company. Commercially pure titanium was drawn in stages on hydraulic presses at a temperature of 500 to 600 F. Fractures have occurred at the lip, but enough good cup remained to make the large steam-jacketed kettles.

The basic problem with welding is the tendency to absorb gases resulting in brittle welds. Battelle reports that the only commercial alpha-beta alloys that are not completely embrittled by arc welding are the 6A1-4V and 1½ A1-3Mn alloys. Alpha alloys can be arc welded, as can the commercially pure metal, but the only alpha alloy commercially available at the moment is the 5A1-2½Sn alloy.

Air Force specifications at present call for a maximum of 0.20% each for oxygen and carbon, 0.07% for nitrogen. Battelle reports that these limits are too high for weld areas, but most commercial alloys are below these limits. The Air Force limit for hydrogen of 150 parts per million maximum in alpha-beta alloys is reported to be adequate for welds.

Machining of titanium presents nothing like the frightening prospect it offered only a few years ago. The greater uniformity, the lower carbon content, and the development of proper methods have all contributed to this change.

Milling is considerably more difficult than turning and there is much interest in the possibility of replacing milling operations with etching. Chemical milling, the process originated by North American Aviation to produce sculptured aluminum skins, has recently been extended to titanium.

Titanium today is winding up a turbulent decade. With development artificially stimulated, we have had to pay the price of haste. But today the metal is available in sufficient quantity to support a major jet program. The following articles report on some of the experience with that program.

Bibliography of articles on Titanium in American Machinist

How to Work—Jun 11, '51, p145-153
Machinability—Oct 1, '51, p 179
Douglas Stretch Forms—Oct 29, p124
Surface Grinding—Dec 10, '51, p183
Open Die Forges Cones—Feb 18, '52, p136
How to Drill—Mar 3, '52, p141
Grinding at Lockheed—Mar 3, '52, p175
CO_2 Cools Tools—Mar 3, '52, p 129-132
Cutting Tests—Apr 28, '52, p91-96
How to Weld—May 26, '52, p93-97
Alloy-Sheet Welding—May 26, '52, p98-99
Spinning Titanium—Jun 23, '52, p137
Torque Teaches Ti Tapping—Sept 29, '52, p102-104
Welding Titanium—Oct 13, '52, p123-125
Turning Tests—Oct 13, '52, p130-134
How GE Works Titanium—Feb 16, '53, p176-181
Internal Grinding—Mar 16, '53, p201-202
Easy to Braze Titanium—Mar 30, '53, p120-121
How to Machine—Apr 13, '53, p185
Be Cagey With Titanium—Sept 14, '53, p129
Cratering Causes Tool Failure on Ti—Feb 15, '54, p147
Cold-Forming by Flotorn Process—Mar 29, '54, p102-105
Titanium-Steel Hot Extruded—Apr 12, '54, p256-257
Spot Welding Titanium Stock—May 24, '54, p163
Machining with Coolants—May 24, '54, p155, 157, 159
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Belt Grinding—Jun 7, '54, p163, 165, 167
Grinding No Longer a Problem—Jun 21, '54, p124-125
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Unorthodox When Machined—July 5, '54, p118-121
CO_2 Concept Machines Tough Alloys—Aug 2, '54, p152-154
Now Titanium Can Be Furnace-Brazed—Aug 16, '54, p117-119
Trepanning Saves Time & Material—Aug 30, '54, p89-91
Conventional Tools Machine—Aug 30, '54, p94-97
Boeing Scale-Inhibiting Treatment—Aug 30, '54, p89-91
Titanium Fasteners—Aug 30 '54, p128-130
Shop Hints Help Form and Mill—Sept 13, '54, p129-133
How Rohr Heats Dies to Form Titanium—Oct 11, '54, p161-163
Ti Friction-Sawed—Oct 11, '54, p185
How Ryan Forms and Welds—Oct 11, '54, p139-141
Spot Welds Work Well—Dec 20, '54, p98-100
Drilling Ti—Feb 28, '55, p145
Mallory-Sharon Expands—Mar 14, '55, p181
Fire Precautions in Handling—Mar 28, '55, p147, 149
How to Machine 3A1-5Cr Titanium—Apr 11, '55, p137-139
Cold Power Spinning Saves Material—May 9, '55, p128
How to Work—Aug 15, '55, p89-104
Alloy Extrusions Fabricated—Sept 26, '55, p105
Cold Extrusion at Battelle—Oct 10, '55, p113
How to Work Non-Ferrous Metals—Mid-Nov '55, p98-107
Case Hardening Ti (Short item)—April 23, '56, p153
Forgings Replace Stainless—May 7, '56, p179
Press Forging Methods—May 21, '56, p113-117
Bandsawing Titanium—Jun 4, '56, p124

Titanium Today

Titanium shrouds J-57 heat in the "Coke-bottle" F-102A, USAF supersonic all-weather interceptor . . .

CASE STUDY:

Fabricating titanium sheet

E J TANGERMAN, executive editor

Titanium shrouds the skin and bulkheads of the F-102A from the annealing heat of its J-57 jet powerplant. Behind that simple statement are several years of experiments, some successful, some very unsuccessful, and many pioneering steps that have made Convair Division, General Dynamics Corporation, a leader in the use of the tough, hard-to-handle, "wonder" metal.

Putting together the shroud for this new "Coke-bottle-shape" Air Force interceptor is today a routine production procedure. But it was not always so. Here, in a few words, we sketch the problems and show the Convair engineering skill that solved them. Then, in seven pages of full-color pictures (the finest group we've ever seen), we show key steps in production and assembly.

Major problems were: 1. Rigidizing the shroud sufficiently to resist column failure (buckling). 2. Welding it without having cracks develop in the weld zone. 3. Making stiffeners without excessive breakage.

At first, the shroud was sheets of titanium built up directly on the fuselage. Fasteners were asbestos insulated to avoid heat transmission that might anneal skin and bulkheads. Then the F-102A's configuration was changed to the new supersonic, "Coke-bottle" shape, and more structural shielding was essential. The shroud became a separate entity, through this series of major production changes:

1 . . Flat sheets of Ti were beaded longitudinally with drop-hammer dies. Too often, the sheets broke. Hot-forming of beads was no better; oxidation was the problem.

2 . . Scale had to be removed by acid etching to improve physical properties. If scale was firm, longer etching was necessary. Sometimes thickness of the 0.012-in. material was halved in the process; this caused considerable rippling or canning.

3 . . Welding, which tends to make Ti "grow," increased the canning problem. Originally, the shroud was assembled from cross-sections 3 ft long. Growth made mating of these sections a problem, so full-length sheets were substituted.

4 . . Hot-formed beaded skins were replaced by flat 0.012-in. skins with V-type hat stiffeners – but the skin still canned. Heavier, 0.016-in. metal was substituted, but it added an undesirable 15 lb per shroud.

5 . . Lighter-gage sheets were rigidized with waffle-iron dimples (produced by Rigidized Metals Co, Buffalo, N.Y.) and U-stiffeners. This solved the canning problem, but raised a new one – structural failure.

6 . . Four 3 x 9-ft sheets were joined by overlap seam welding. This flattened out the dimples, magnified the tendency of Ti to grow, and resulted in weld-zone cracks.

7 . . Heat-treatment to stress-relieve the material before seam welding did no good – cracks still appeared. Butt joining, with a flat Ti doubler, enabled sheet edges to grow without additional stress. Since this method was adopted, not one failure has occurred.

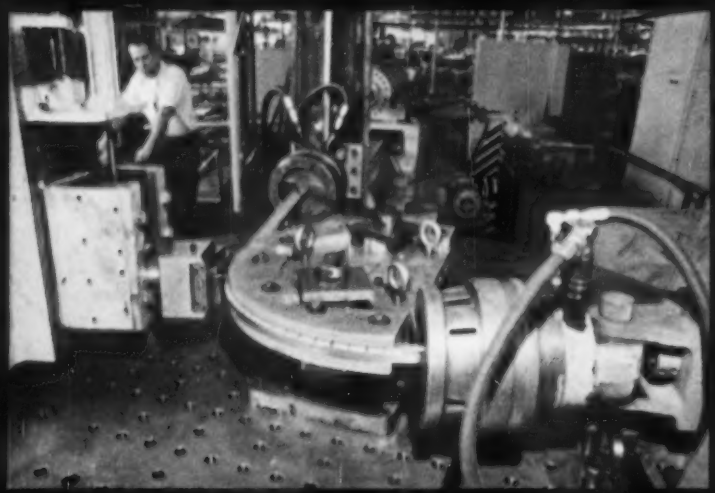
8 . . But here was a new problem: too much heat in the cone section of the shroud surrounding the afterburner. Original Ti could withstand only 600 F, but A-110 AT Ti alloy could withstand 1100 F. This high-strength, high-temp alloy now forms the tailpiece of a separate cone, with five outside circular stiffeners, which is butt-welded to the cannular section.

9 . . Hat-shaped stiffeners or ribs, ½ in. tall by 1½ in. wide, were bent on brakes, then bowed by stretch forming. Heavy breakage in stretch-forming was eased by heat-restoration treatment, but the real solution was wipe forming – faster, no heat-restoration treatment required, and no breakage.

Now see the rest of the story in pictures . . .

Titanium Today

1 Three brake operations form the stiffener "hat" section. This is the third



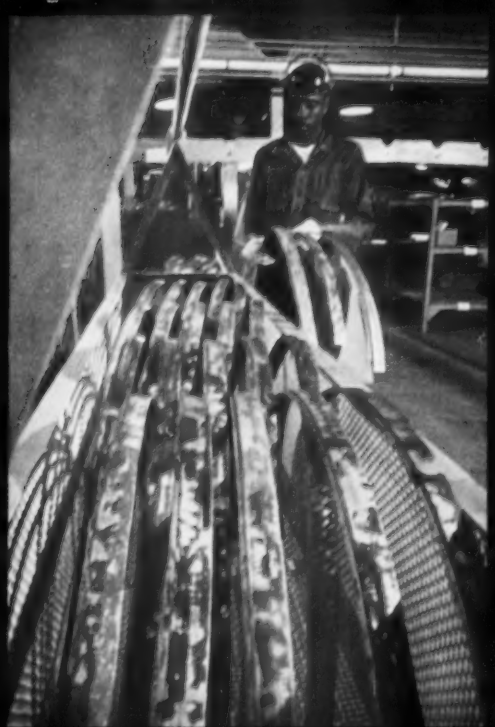
2 Circular stiffeners are in two halves riveted together. They are wipe-formed on a Cyril Bath machine

3 Formed stiffeners are loaded on "HATO" (handling tool) fixtures for stress-relieving at 1000 F for 30 min in a car furnace

4 Rockwell inspection checks stress relief. Circular sections are spaced every 12 in. inside the skin, which is seam-welded to them

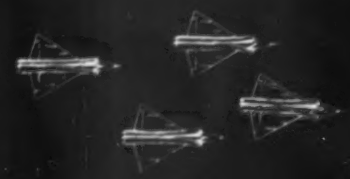
5 Trimming to size is done on a Do-All band-saw with simple fixturing

6 Portable tools do deburring (two methods shown), followed by dimensional inspection



7 Sections are grouped in baskets for acid etching to remove heat-treat scale and prepare for surface inspection

8 Penetrant inspection is one of the checks for flaws given both circular and longitudinal stiffeners



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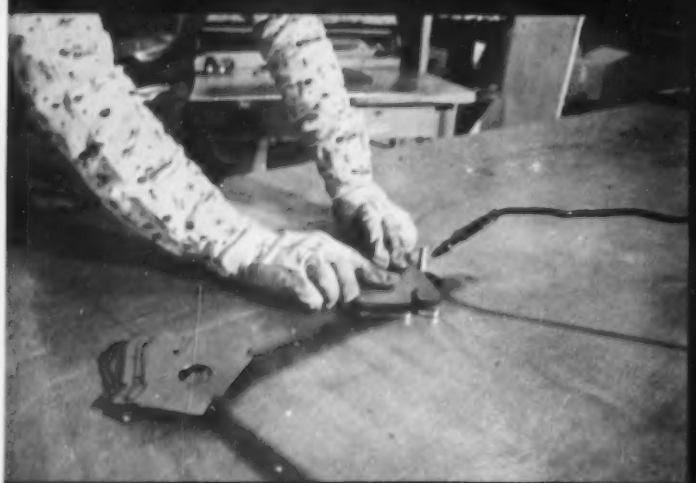
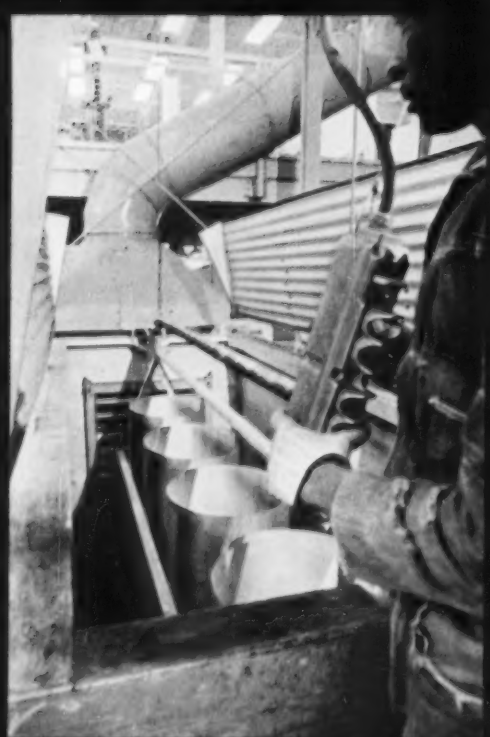
Black light (Zy Glo) inspection is given all critical parts of the assembly



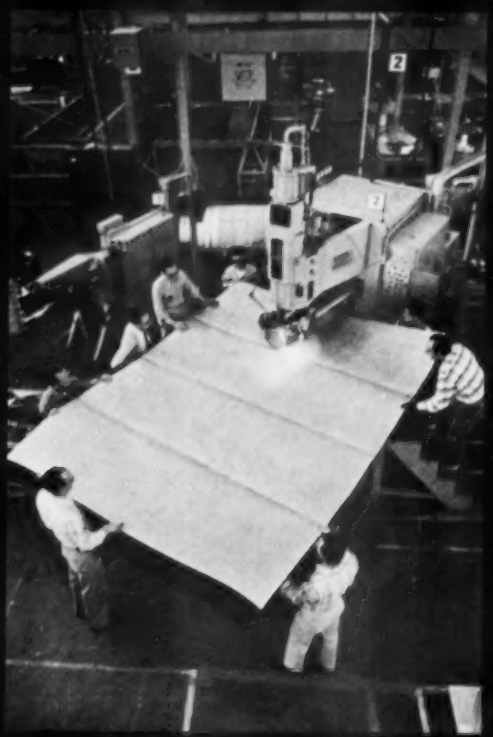
10 Details, also of titanium alloy, are routed on a table machine by usual aircraft practice



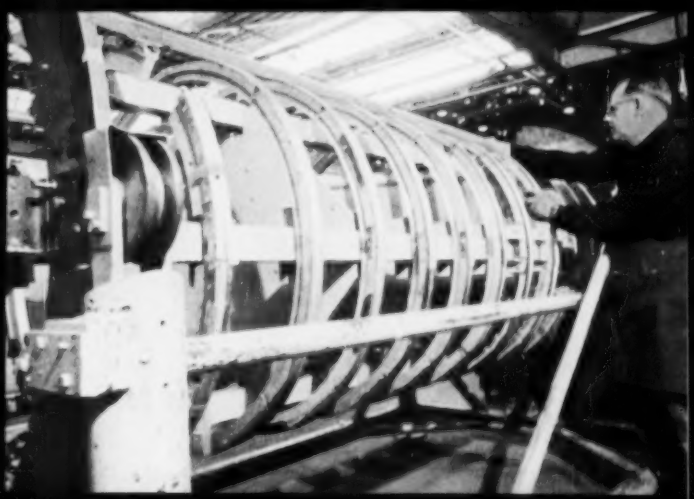
12 Rigidized sheet is cleaned and rinsed in tanks, then dried in this pit oven

11

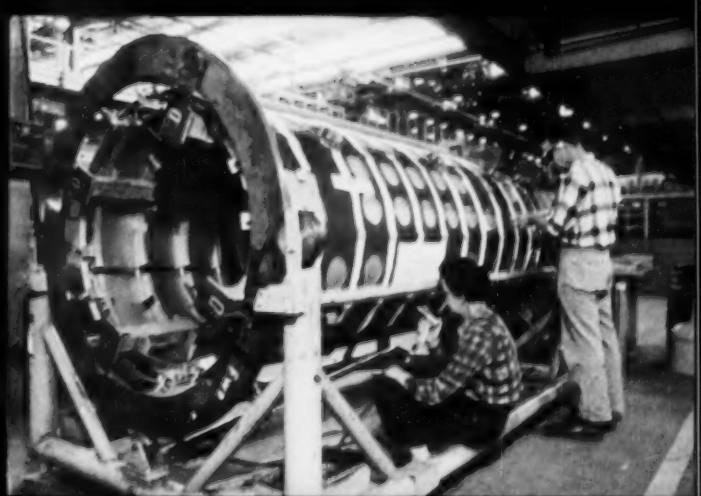
Deburring follows routing, is also done on a table type machine



13 Skin for the cannular section (44 in. dia x 10 ft long), is made of four Ti sheets seam-welded together



14 Circular stiffeners are mounted in a fixture with sizing plates so the assembly can be rotated on end rings



15 Skin is wrapped over ribs, holes are drilled for sizing, and the final joint section drilled for Cleco fasteners

16 Drilled skin is removed, cleaned (shown), final seam spot-tacked and replaced. Stiffeners are tacked, then seam-welded and final joint overlap spot-welded

17 After-section, a cone, is bench assembled separately (shown), with five outside circular stiffeners spot-tacked in place

18 Stiffeners are finally seam-welded. The after-section will now be welded to the cannular section

19 Lower (shown) and upper forward shrouds, which seal off any hot air that might move forward, are bench assembled

20 Seam-welding holds circular stiffeners inside forward-shroud halves. A Sciaky welder does the job

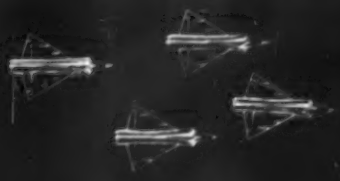
21 Longitudinal stiffeners are overlap-spot welded outside forward shrouds. These halves will later be clamped to the cannular section over asbestos-strip seals

22 Visual inspection with a neon light completes forward sections, which are lined with Inconel blankets between stiffeners

23 Cutouts in the assembly are jig-drilled and marked. Note dimpling to rigidize skin (here and in earlier photos)

24 Door openings are routed in with an air motor and tapered reamer. Sliding doors, to cover these openings, are separately made of Ti sheet

halves. A Sciaky welder does the job



Titanium Today

25

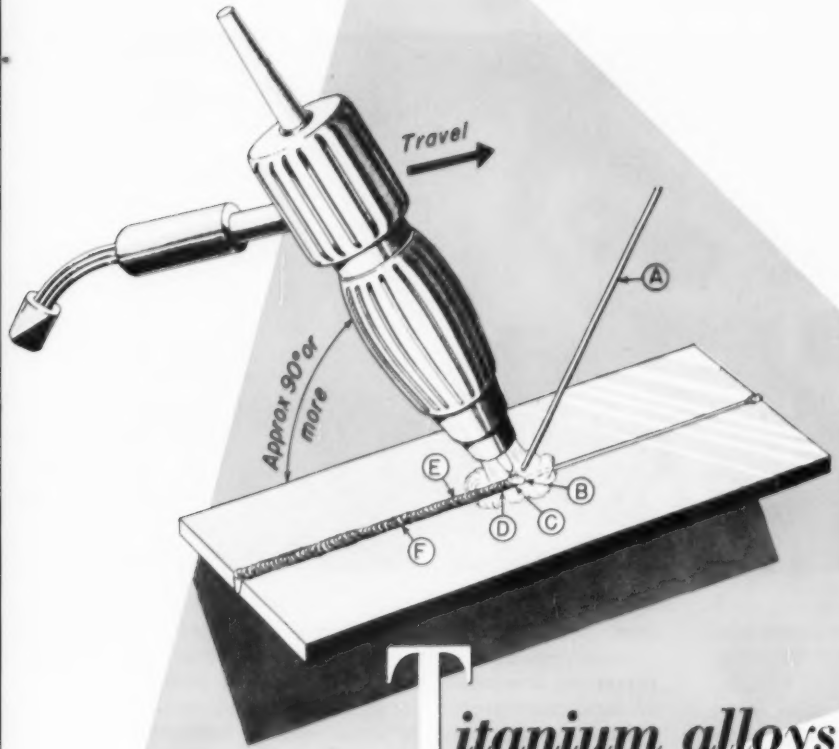
Longitudinal stiffeners are overlap spot-welded about a foot apart outside during final assembly. They are riveted where they cross inside stiffeners

26 Inspection succeeds final welding. Any faults are corrected before Inconel insulating blanket is installed. Note castered carrier on rails

27 Inconel (high-temp nickel-steel) foil blankets, prepunched, are set over studs in shroud between circular stiffeners. A washer and cotter pin complete the assembly

28

Final operation is, of course, to install the shroud on the engine. Then the assembly goes in the plane, as shown initially



Clean, sound welds . . . require these precautions: (A) Filler rod submerged constantly in gas envelope during welding and afterward until cool. (B) Molten area of puddle directly under and equally surrounding outer periphery of arc stream, well within gas curtain. (C) Plastic stage of metal, directly adjacent to periphery to molten puddle, is still within gas curtain. (D) Beginning of solidification (above 1300F) directly in back of plastic stage. Here, contamination ceases, still within the gas curtain. (E) Weld below 1300F and at outer fringes of gas curtain, so discoloration begins. (F) Various hues, developed by variable and dissipating heat, are superficial and can be avoided by extending gas protection. Special trailing cups which cover hot weld bead longer give better results than conventional ceramic gas shield shown

Titanium alloys arc welded in open air...

Exhaustive recent tests prove fusion welding of titanium alloys in the open air is practical and economical with automatic inert-gas-shielded tungsten arc. Manual welding with the same arc also looks promising, but still requires a very high level of "operator integrity"

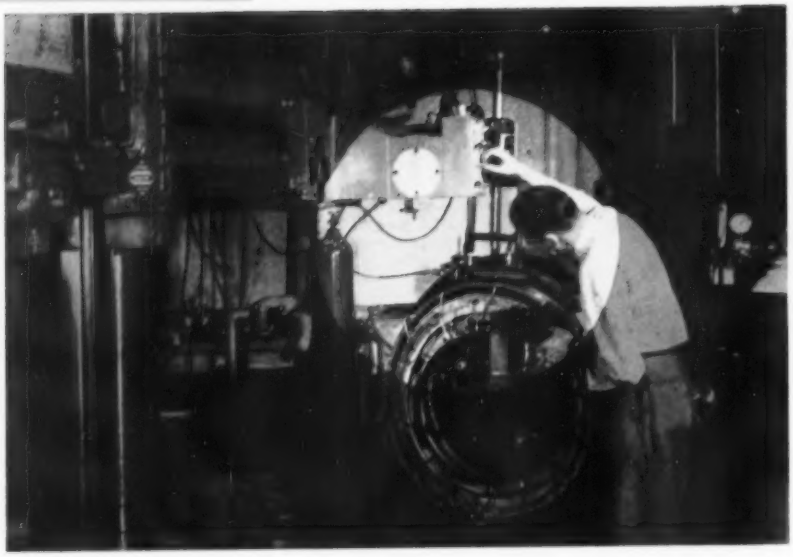
BEN C BROSHEER, associate editor

Titanium and its alloys have high affinity for carbon, oxygen, hydrogen and nitrogen when (1) heated to plastic or molten states, or when (2) repeatedly heated for extended periods to temperatures above 1300 F. Contamination with any of these elements makes the metal brittle, and it loses its ductility and tensile strength. Hot working and welding therefore must be performed with considerable care.

Experience has proved that satisfactory welds can be made in the open air with resistance welders having sufficient current and pressure capacity, providing the material is free of heavy oxides and joint surfaces are cleaned adequately.

But fusion welding is another matter. Until recently, arc welding of titanium has been confined to the non-consumable tungsten-electrode arc process inside leakproof tanks filled to slightly above atmospheric pressure with a pure inert gas like argon or helium.

Recent tests with inert-gas-shielded nonconsumable-tungsten-electrode arc-welding equipment in the Semi-Production Dept at Ford Motor Co's Aircraft Engine Div plant have proved that, under proper conditions, titanium alloys can be fusion welded in the open air—providing there is adequate shielding to prevent contamination of the heated metal. The work has been carried forward principally by M C Jay, welding engineer, and Jack Hanover and Al Manos, machine production engineers in the Semi-Production Dept, assisted by Roy Handley, test engineer in the Weld Test Lab of the Chemical & Metallurgical Engrg Dept, and in production welding. (*Next page, please*)



Radially adjustable . . .
Weldaction welder with precision Weltronic controls and Airco Heliweld head is teamed with automatic power-operated Sciaky positioner equipped with air-actuated Fawick expanding chuck for welding circumferential seams in titanium sleeves for jet aircraft engines. Mixture of argon and helium shields both sides of weld from atmosphere

Both automatic longitudinal and circumferential seam-welding machines, and manual welding torches, have been used successfully. But, to date, the automatic controls that can be built in seem essential to success of the process on a production basis.

Failure to turn off arc current, and to allow the weld bead to solidify and cool, before removing the filler wire from the shielding gas curtain and before lifting the torch from the work, can result in brittle, porous welds—so a considerable amount of operator skill and integrity is essential when welding manually. Manual welding is further complicated by the need for shielding the back side of the weld joint with inert gas throughout the welding cycle.

These factors are important to success:

1. . Size and shape of inert-gas shielding cup.
2. . Pressure of gas supplied to the shielding cup.
3. . Arc density and length (current and voltage).
4. . Type and cleanliness of filler wire, and wire-feeding technique.
5. . Design of weld joint, and cleanliness of joint surfaces.
6. . Outside air currents.

Shielding cups

Basically, the shielding cup mounted on the end of the torch to confine the inert gas around the hot weld metal should be larger than one suitable for a comparable joint in stainless steel. The larger the cup or shield: (1) the greater the coverage of heat-affected zones, (2) the greater the volume of gas that can be used to shield the weld without stream or velocity effects, and (3) the less chance of atmospheric inspiration.

Cups originally were the conventional ceramic type for Heliarc tungsten-arc torches. However, where joint shape permits, experience has shown that special trailing shields (see photos) are best.

Shielding cups for automatic welding machines preferably are made with clear plastic top and side surfaces, so the operator can see the weld as it is made. On some circumferential welding operations, it is desirable to add drag curtains to retain the shielding atmosphere above the bead longer.

Inert-gas supply

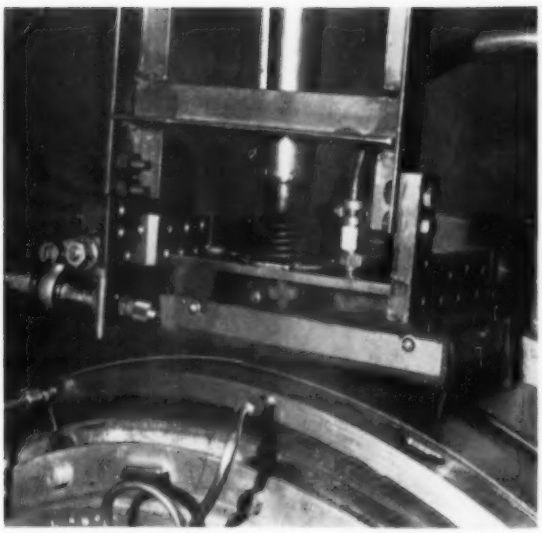
Both argon and helium are used to form the protective curtains necessary. Generally, 100% argon gas is used in welding tanks and for manual welding in open air. For automatic welding machines, a mixture of 75% argon and 25% helium seems to work best. Argon gas is used in each case for back-up shielding on the reverse side of the welds.

When a trailing cup is employed, either for machine or for manual welding, gas is piped both to the torch and to the elongated shield. Gas supply pressures should be proportional to the size of the shielding cup in each case, but should never be more than just enough to insure a slightly positive pressure inside the shield. Excessive supply rates or pressures will create a stream or jet action which tends to draw the outside atmosphere into the weld.

For conventional ceramic cups on manual torches, these supply rates generally are suitable: No. 3 cup, 6 cfh; No. 5 cup, 10 cfh, No. 16 cup, 16 cfh. Cups with trailing shields for manual torches must be tested to determine correct supply rates.

For automatic welding, with the shields and machines shown, the following supply rates have been found suitable: (1) gas to torch, 10 to 20 cfh; (2) gas to shield, 15 to 30 cfh; (3) gas to backup shield, 7 to 20 cfh. These rates vary with size and shape of enveloping shield, welding rate, and like factors.

It usually is desirable to diffuse the gas fed to the shield through a metal screen or, preferably,



through a small section of ¼-in. thick sintered bronze-powder metal filter, so it will flow down around the weld with only slight pressure.

Porous welds sometimes can be caused by incoming inert gas that is too wet. Dewpoint should be minus 60F. To insure that only dry gas is used, all units have been equipped with refillable dryers in gas supply lines. These dryers are filled with 1/16-in. pellets of Type 5A Linde molecular sieves, which can be removed, dried and reused.

Because a long arc, like excessive gas flow, will tend to draw outside air into the weld area, output of the welding machine is preset to provide only the current necessary to attain desired weld deposit.

Filler wire

When filler wire is necessary, the following types have been found suitable:

- For low-strength alpha titanium alloys, like AMS 4900, AMS 4901, AMS 4902 and AMS 4921, use commercially pure titanium.
- For high-strength alpha titanium alloys, like Rem-Cru A-110-AT, and for high-strength alpha-beta alloys, like PWA 682 and PWA 683 (6% aluminum and 4% vanadium), use a filler of the same composition as the parent metal.
- When joining dissimilar titanium alloys, use the filler metal best for the lower-strength alloy.

In all cases, the filler wire must be clean of all foreign matter other than its inherent oxide.

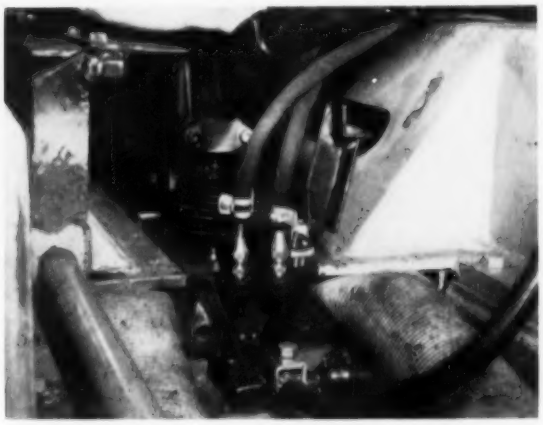
Long shield . . .

replaces conventional ceramic cup on this tungsten-electrode inert gas-shielded torch for manual welding of titanium joints in open air, so weld bead is covered with gas curtain until cooled below point where it will discolor when exposed to the air. Inert argon gas is fed through torch, and directly into the shield, at very low pressures

(CONTINUED ON NEXT PAGE)

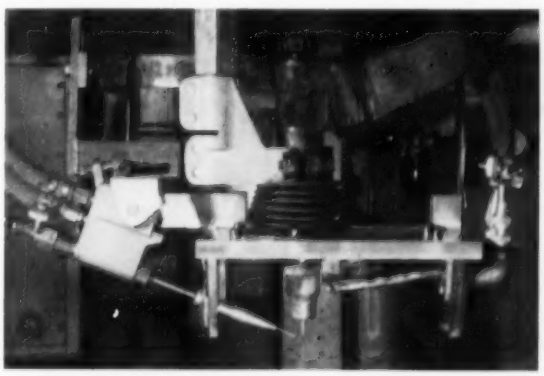
Shield around Heliweld torch . . .

for circumferential welds in titanium sleeves fits closely around workpiece to eliminate inspiration of air into weld area. The longer a bead is allowed to cool, the less it will be discolored



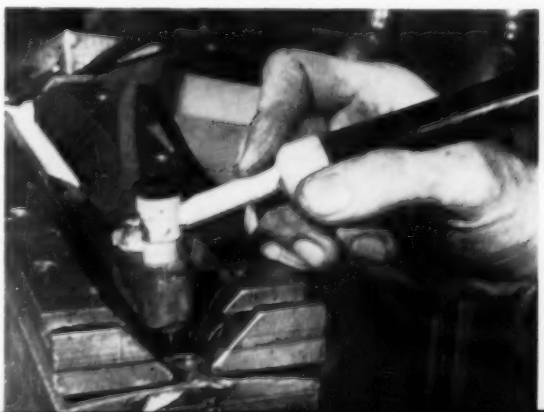
Copper backup . . .

and clamp bars in seam welder rob heat from weld too rapidly, so this Pandjiris machine converted for inert gas-shielded arc welding of titanium alloys uses mild-steel bars. Magnetic blow in welds is prevented by connecting ground wire to backup bar, and traversing Heliarc torch away from ground location. Gas shield rides on clamp bars



Clear plastic shield . . .

for longitudinal seam welder is open on both sides because machine clamp bars help enclose inert gas during welding operation. Before weld is started air is purged from shield by pumping flexible rubber bellows up and down several times while gas is fed into shield. Bellows is used for connection to torch, to eliminate side pressures



For manual welding, the short lengths of filler wire should be degreased, then handled only with clean gloves. Even fingerprints can carry enough foreign matter into the weld to cause trouble.

For automatic welding, not only should the coil of filler wire be degreased, but the feed knurls and their enclosure, as well as the tube through which the wire is fed to the torch, must be cleaned carefully. Also, knurl pressure against the wire must not be sufficient to mark the wire and form grooves which can pick up dirt and carry it into the weld.

Once the filler wire has entered the gas shield at the torch, it must not be withdrawn until the arc is broken and both weld and filler wire have been allowed to cool. In addition, the oxidized end of the filler wire from a previous operation must be clipped off before the wire is used for a succeeding operation.

Oxidized filler wire will produce contaminated and brittle welds without visual indication. The bead produced with an oxidized filler can be clean and silvery in appearance, and yet be completely unsatisfactory.

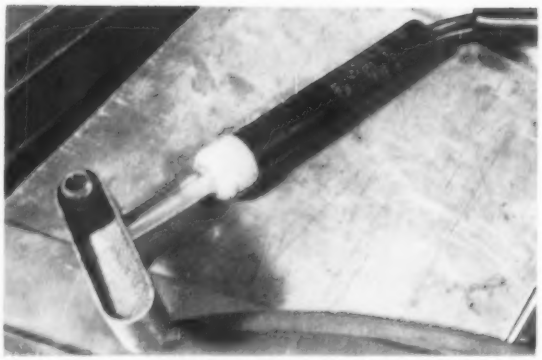
Bad welds can be expected if outside air currents, caused by circulating fans or open doors, interfere in any way with the protective gas shield around an arc weld being made in a titanium joint.

Quality control

Titanium weldments must be free from excessive carbon, hydrogen, oxygen and nitrogen pickup, must have a bright clean or a very light straw colored surface, and must satisfactorily pass bend-test requirements. Because no really satisfactory nondestructive test has yet been devised for titanium welds, bend test specimens are made at regular intervals—whether the welds are made in a tank, or out in the air with automatic or manual procedures.

Superficial discoloration of weld surfaces, which can be removed by the pickling treatment which normally follows every welding operation, no longer is considered cause for rejection of a weld made under carefully controlled conditions—providing, of course, that test specimens made at the same time, and under the same conditions, pass bend and tensile tests. Bend is 105° around a pin of diameter equal to four to six times metal thickness (depending on alloy), with no cracks larger than 1/16 in. in any direction.

All fusion welds in titanium alloys must be stress relieved soon after welding is completed, then cleaned by acid pickling. Alpha alloys generally are stress-relieved by heating to within 25F of 1000F for 2 hr in air. Alpha-beta alloys (containing 6% aluminum and 4% vanadium), and weldments containing these alloys in combination with alpha type alloys, are stress-relieved by heating to within 25F of 1300F for 2 hr in vacuum, or in a suitable inert-gas atmosphere, then cooling to 1000F under the same conditions, before removal to air.



Diffusing inert gas . . .
through sintered bronze powder metal filter reduces possibility of flow streams that might cause outside atmosphere to be drawn into weld area while metal is hot. Elongated shield generally must be designed specially for each welding operation, for best results

For small parts . . .
it is best to fusion-weld titanium inside a leakproof tank purged of air and containing a protective atmosphere of argon gas. This unit has 8-cu ft capacity, is loaded through a gas-filled chamber at the rear, to conserve gas, and has safety glass window through which operator watches work. He manipulates work and torch through rubber gloves

Formed sheet titanium vanes . . .
for jet engine shroud ring are welded with tungsten torch inside gas-filled tank. Such easy-to-manipulate parts probably will be welded inside tanks for a long time, leaving manual welding in air for larger parts and assemblies. Five purging cycles insure all air is out of tank before welding

Round Table

Night Time's for Sleeping

"Boy, Ed; you ought to hear the grumbling going on out in the shop this morning. You'd think a murder'd been committed or something, the way the complaints are sailing around."

"What's the matter, Al?"

"Well, the way I heard it, the general manager was working late last night and walked out into the shop to check one of the new jobs. When he got there, the lathe operator on the next machine was sitting on a box, 'resting' while the machine was taking a long cut. He blew his stack, of course, and gave the man a week layoff right on the spot."

"Well, what'd he do that for? If there was no danger or anything, why didn't he look the other way until somebody could warn the operator?"

"Why should he do that, Ed? The book says when the tool is in the cut, you're supposed to be on your feet watching it, to make sure nothing goes wrong."

"Oh, I know that, Al, but I also happen to know that job. Bet it's the one where the cut takes twenty minutes or so, at least. Right?"

"Sure that's right, but the book says . . ."

"Hang the book! You know as well as I do that the night men have always been taking it pretty easy. They get the work out, but they just cut a corner here and there when it won't hurt anybody."

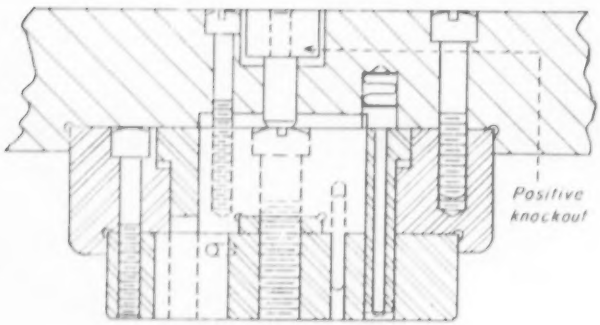
"Maybe so, but that doesn't mean they aren't supposed to take the rap if they get caught cutting those corners. Those guys goof off strictly at their own risk, Ed. I don't feel much sympathy for them."

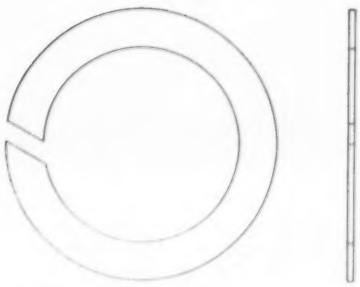
"Boy, what a night foreman you'd make, Al. You'd have the men down around your ears in no time. Ya gotta give a little, pal."

"Not when it comes to that, Ed. When somebody breaks the rules and gets caught, he's got to take his medicine."

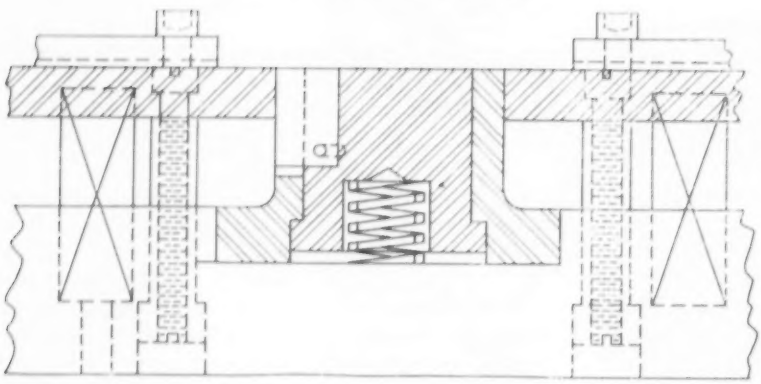
***SHOULD THE NIGHT SHIFT** be allowed to get away with minor rule infractions or is Al right in feeling no sympathy for the man who got caught? Your opinions may help others. Discussions of earlier topics start on page 212.*

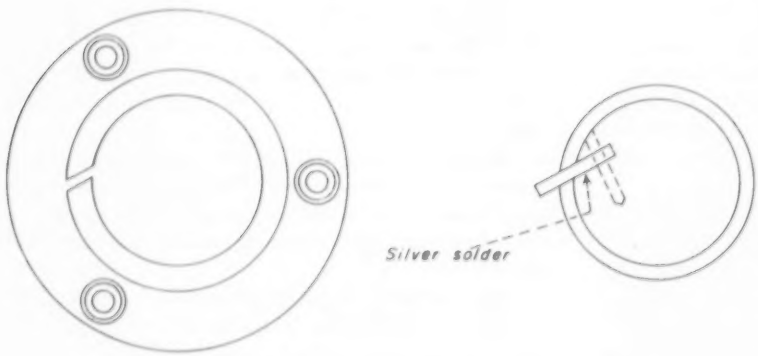
Compound washer die costs 30% less

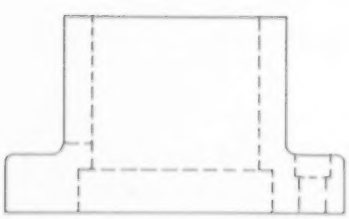




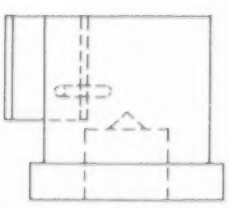
FLAT SPRING WASHER







Lower punch



Lower shedder

WILLIAM C BETZ

Only a compound die will produce flat spring-steel washers with concentric hole and OD. These parts are generally made of stainless steel or blued spring-steel stock. If these parts are made in a combination die, the size cannot be maintained, because of the clearance needed, and because concentricity is adversely affected by pilots fouling in the hole. Further, a combination die requires four stations to do the work. The operations would be stamping, piercing, slitting, and blanking. A suitable tool for a washer 2 in. in dia would require about 120 hr to make.

The compound die can be made in about 85 hr and it does a much better job. Stamping, piercing, slitting, and blanking are done at one time. Because all of the blanking and piercing members have straight walls, the blanks will all be of a given diameter throughout the life of the die. No increase in diameter of openings will occur when the tool members are sharpened. Besides, the blanks remain flat.

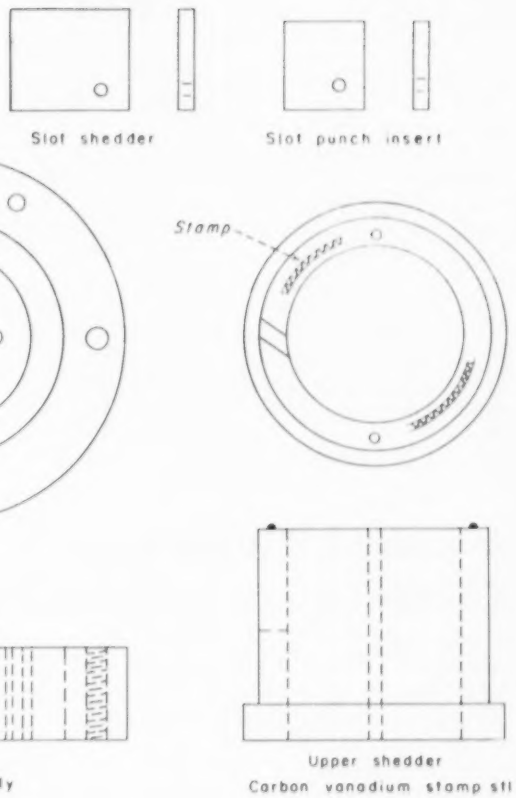
Certain parts of the tool should be made of high-speed steel, which is hardened and double tempered. After these parts are assembled by silver soldering, the hardness will remain at Rockwell 59-60 C in order to provide long-lasting cutting edges. The parts in this category

are: the die-assembly rings, the lower shedder, the slot shedder, and the slot-punch insert. Other parts of the die can be made of air- or oil-hardening steel, except that screws are made of cold-rolled steel and case hardened.

To locate the die and punch assembly properly, a cast-iron bushing should be made to keep the parts concentric during silver soldering. This bushing will be a snug fit in the die and the OD of the punch.

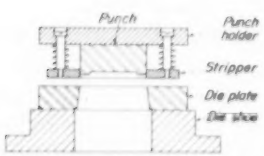
The die layout shown allows the center scrap to be drawn towards the direction of feed through the slit scrap, which prevents the center from fouling as it is carried over the die.

The press should have a stroke at least equal to the diameter of the blank to allow the shed blank enough room to be blown clear of the tools with an air blast. The press may be run at 150 to 200 strokes per minute. After producing 40,000 to 50,000 blanks, the tools will require sharpening because of the hardness of the spring stock.

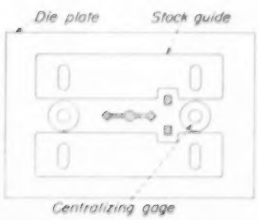


Diemaker's Kinks

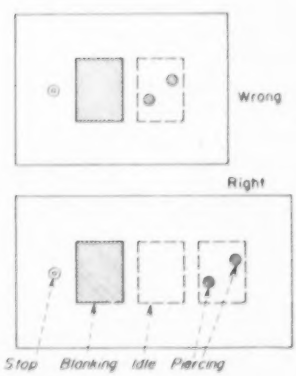
FEDERICO STRASSER



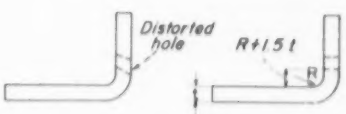
SPRING-ACTUATED pressure pads are excellent for holding down stock up to say ⅛ in. thick, to avoid the formation of wrinkles. Above this stock thickness, the required springs may be too large for the available space.



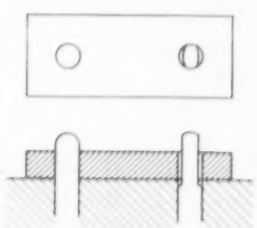
STOCK GUIDES for precision operations, such as making razor blades, must be positioned accurately after regrinding the die. To accomplish this, bore two centrally located holes to receive the centralizing plugs or gages. Insert the gages, bring the stock guides up to them, clamp the guides, and remove the gages.



AN IDLE STATION between piercing and blanking in a progressive die is good practice, especially where there is danger of "crowding" a slender punch and breaking it.

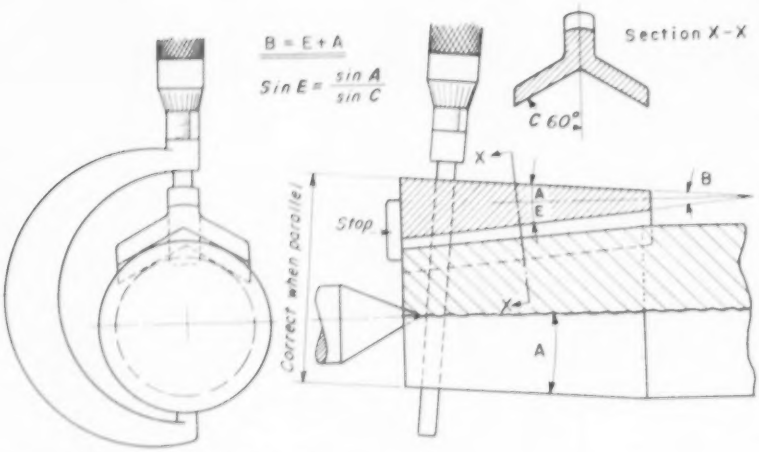


HOLES in bent workpieces should be positioned so that the hole edge is not closer to the bend than 1.5 times the stock thickness plus the radius of the bend. If holes are placed closer, they are likely to be distorted during bending of the stock.



LOCATING PINS in second-operation dies should consist of one round pin and one pin with the sides relieved, nearest and farthest from the other pin, for easier loading and unloading.

Practical Ideas . . .



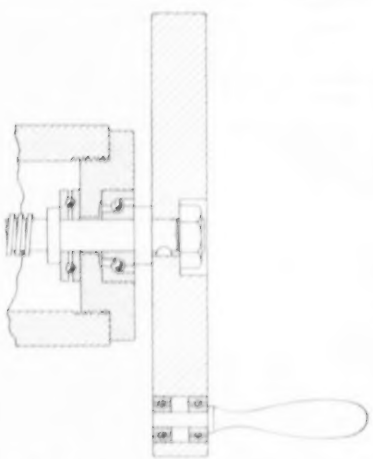
Improved V-Block Gage Checks Tapers And Diameters

I read your practical idea "Indicator And V-block Check Tapers" (*AM* Mar 26 '56 p 125) by P H Winter, but it seems to me the suggested gage will not work well. Only one diameter can be checked, and for that there should be a stop somewhere. If you push the workpiece further in, the indicator will raise, and therefore no correct reading can be taken.

I have, I believe, an easier method of checking tapers and taper diameters. The work can be left in the lathe or grinder, without disturbing the center. All you need is a gage and a micrometer.

The gage is made of tool steel, which is hardenend and ground after machining. Proper taper of the gage may be found by applying the formula enclosed. A stop on either end will locate the gage to get the correct diameter. A rubber band will hold the gage to the work if both hands are needed for measuring.

A Vetsch, Seuzach, Switzerland



Ball Bearings And Flywheel Speed Up Tailstock

We have improved the tailstocks on a few of the lathes in our shop by adding a ball-bearing assembly and small flywheel in place of the usual handwheel. This has proved to be a good investment for drilling chucked parts in the lathe. Less effort is required to penetrate with a large drill because the pressure applied is directly on the drill and none of it lost by friction.

The flywheel, mounted on the end of the screw, makes withdrawal of the drill a pleasure. All that is needed is a good spin of the wheel and the spindle will travel several inches because of momentum.

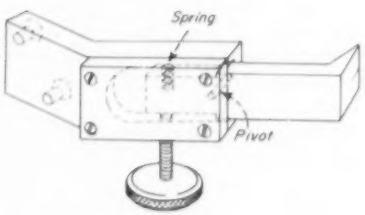
We also provided the handle on the wheel with a pair of ball bearings, but this is optional, for a rotating handle on a stationary shaft can be made to serve satisfactory.

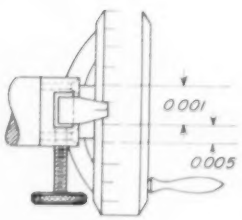
Clint McLaughlin, Rockaway, N Y

Adjustable Grinder Finger Gages Stock Removal

More certain stock removal on a surface grinder is the advantage of this attachment, which fits next to the vertical feed wheel.

Graduations on most grinders are spaced 0.0005 in. apart, and if the operator wants to remove 0.0005 in., and the scribed line on a fixed finger falls between two graduations, there is often room for confusion. Using this adjustable finger, the operator can adjust it before he takes a cut so graduated line will come up to the scribed line on the finger when the grinder has fed down the right amount.





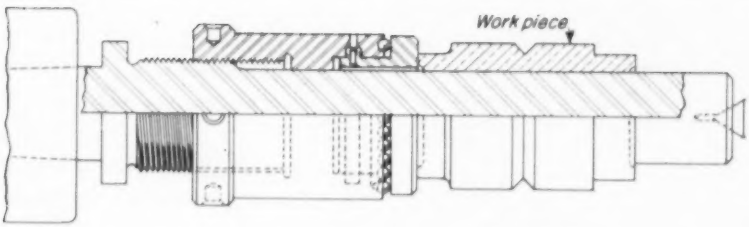
A small coiled spring is directly above the small thumbscrew, between the finger housing and the top side of the finger. This provides back pressure against the screw so the finger will stay put. You only need a few thousandths of motion in the finger.

Albert H Provost, Ludlow, Mass

Save Old Scales

Rusty, worn scales held in the toolbox can be reclaimed by surface grinding a few thousandths off each face to make the numerals show up again. The same amount off each edge won't damage the scale at all. The only edges you can't regrind are the two ends.

John Cokor, Wickliffe, O



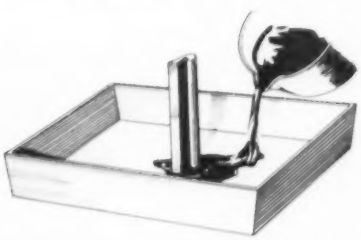
Adapted Mandrel Saves Finished Ends of Soft Aluminum Parts

We regularly had large quantities of long thin-walled aluminum sleeves to machine, the outside to be concentric to the bore. But we ran into trouble in removing them from a standard mandrel because of the thin side walls and the softness of the metal. Therefore we made up this special jacking mandrel.

It has a Morse tapered shank to fit the headstock and is center-drilled in the opposite end. It is then turned to suit your need with the usual taper.

Jack assembly is made up of a nut and thrust collar, with a groove in the nut to hold bearing balls. A locking pin is used to hold the assembly together. Four holes are drilled in the nut collar to receive a pin or spanner wrench. The nut and thrust collar are then hardened.

W M Halliday, Lancaster, England



Temporary Die Saves Metal

It is often necessary in die and experimental shops to turn out small quantities of blanks for samples and die tryouts. Construction of a complete die for these reasons would be costly, for it may later have to be discarded because of changes. Therefore a lot of time and material can be saved by using this setup.

A form for pouring a fusible alloy is first built, its dimensions will vary with the size of the job, allowing space for guides and stops. We then make a punch of steel, as close to size and shape as we can calculate. It is then hardened and tempered as usual.

After punch has been placed, with the cutting end down, in the desired location of the form, molten Zamac is poured around the punch to the thickness wanted. We chose Zamac because of its high tensile strength and low melting point (715 to 718°). After cooling, the form and punch are removed from the cast block.

Standard methods are use to prepare the block, such as facing both sides, tapering the molded hole to provide clearance for blanks, drilling, and tapping. Where die dimensions are known, but there is only a small demand for parts, we use the same method. The die metal can be remelted and used over again.

W Doorn, The Hague, Netherlands

Center Improves Drill

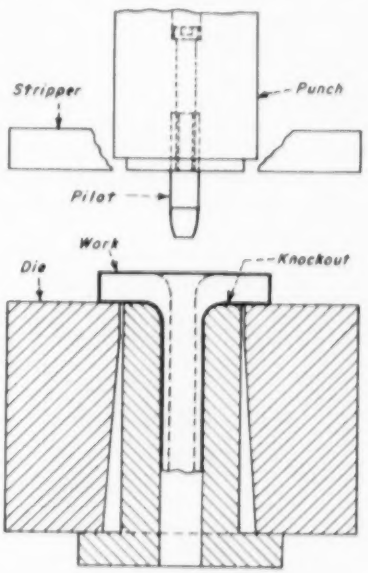
In a recent issue, (*AM*—May 7 '56 p 165) Mr Federico Strasser of Santiago, Chile, suggested a modified drill for plastic. I'd like to further enlarge on this idea, in that a center be ground on the tip.

This idea is not original, for it is being used in the woodworking industry when a hole must be drilled into the end grain of wood. The center insures alignment and minimizes wandering of the drill.

The corner of a grinding wheel can be used to form a drill in this manner, keeping in mind that both cutting edges should be of equal length, and that the center runs true.

Sheet metal and brass can be drilled with this point, and should be backed up with a block of wood, whenever possible, to reduce burr formation.

Anton J Trykoski, Chicago, Ill



Improved Punch Makes Cleaner Cuts

We recently had to blank out the head of an extruded aluminum part from its original diameter of 1⅜ in. to a finished size of 1 in.

Using a conventional punch and die on 2S aluminum, we got a typical rough-edge finish produced when blanking thick stock, the head being ¼ in. thick. It was necessary for the 1-in.-dia head to be square with the top and have a smooth edge.

I redesigned the punch as shown. The combination punch swaged and then blanked the head as it descended.

Lloyd A Manus, Sylvania Elec. Prod., Inc., Hicksville, N. Y.

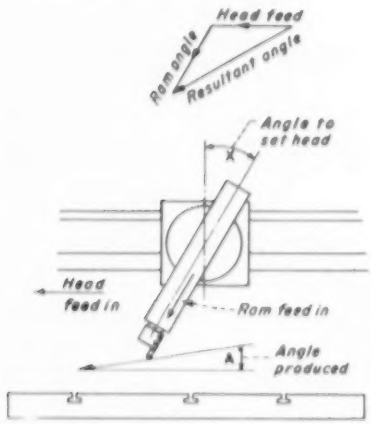
Spring Scriber Marks Without Gouging

When working on milling machines and jig borers, I have found this machine scribe valuable. After many attempts with a solid scriber that would give me a heavy and irregular line because it would dig in, I developed this spring scribe. It will actually float on the surface of the work, leaving a thin definable line.

Two things of importance are: Scriber should have a sliding fit without play in the housing, and point should be concentric with the outside of the housing. This can be accomplished by setting up and indicating the housing, then grinding the point.

Tension on the point is adjustable if a not-too-heavy spring is used.

Ted Hilger, Andale, Kans.



Mill Cuts Angles; Geared for Dual Feed

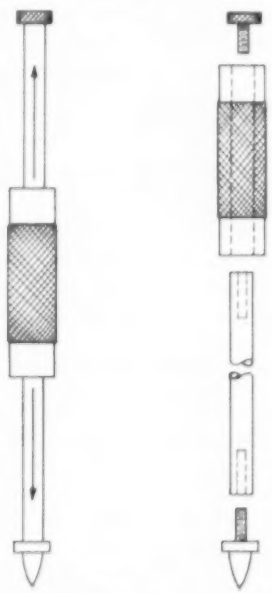
We have often used a boring mill or VTL to machine an angle, thereby saving considerable time and trouble. The key to this idea is operating both head and ram under power, with the ram tilted from the vertical to move in a slanting direction. The combined feeds move the cutting tool at an angle across the work.

We start with the two feeds at a 1:1 ratio—that is, the ram and head are geared to feed at the same rate. Actually, any other ratio may be used, but 1:1 makes the calculating much easier.

If the ram is moved vertically, and the head is under power across the work, the tool would cut at 45°. But the ram is usually tilted to provide for some other angle. If you are given the angle to machine, multiply by 2 and subtract from 90°. This gives you the angle of the ram (from vertical); or $90 - 2A = X$.

You can cut up or down, to left or right.

Victor W Rogers, San Jose, Calif



Simplified One-Hand Centerpunch

In centerpunching soft material, uniformity is sometime hard to come by, even if an automatic centerpunch is used. That was my problem recently, and the reason for this simple tool.

It is made up of four parts; the hammer, rod, retainer cap, and the point. All parts are made of drill rod and hardened.

In operation, move the hammer to the top, hold there until point is on the desired location, then let the hammer fall. Thus you'll have a small even mark every time.

N V Usherwood, Stouffville, Ontario

Winners No. 250

H NORMAN BOLES
J MANGANO
FEDERICO STRASSER

won $25 in addition to regular payment for their ideas:

Eliminate Scale When Hardening
Turnover Jig For Drilling
Tap Stampings In The Strip

in the issue of May 7, 1956

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

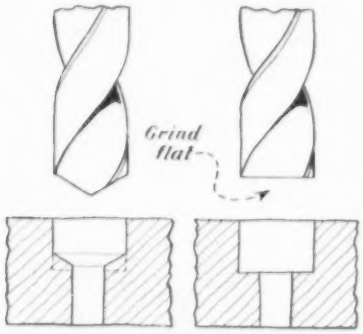
PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



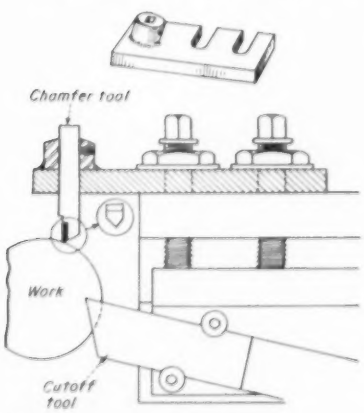
Substitute for Piloted Counterbore

When there is no piloted counterbore available for a given size, a reasonable good job can be done with three ordinary drills; one of them ground to simulate a c'bore.

First drill a pilot hole somewhat smaller than the counterbore required. This acts to guide the second operation, which is drilling to partial depth with a drill that is the counterbore dia. Finally, drill the final fraction of an inch with an identical drill that has had the tip ground down. This allows the flutes to cut a rough counterbore.

The second drilling step is important because a partly drilled hole of the proper diameter will prevent the ground-off drill from wandering.

Fred Buehler, E Rochester, N Y



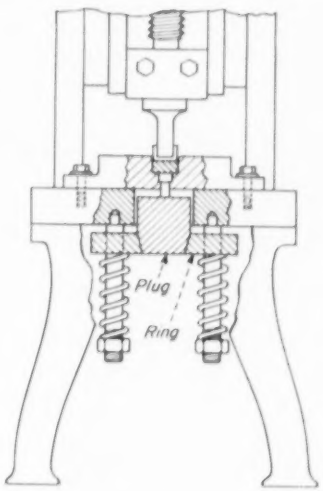
Get a Chamfer Without An Extra Operation

When you find the need for an extra station on a square turret, so a chamfer or a radius may be formed, here is a handy way out.

A length of steel plate, which will vary with the size of your machine, is cut and notched to fit your tool-holding bolts under jamb-nuts. Place a piece of steel on the outer end, by means of welding, to serve as reinforcement for the tool-bit. A hole is machined through this arrangement to hold the tool-bit you want to use.

Tool should be held at a 90° angle to the travel of your parting tool, with a setscrew holding it at the desired depth. Arrange tools so chamfering is completed before parting is too far advanced.

Phil McCafferty, Stanwood, Iowa



Removable Ejector Plug Simplifies Press Setups

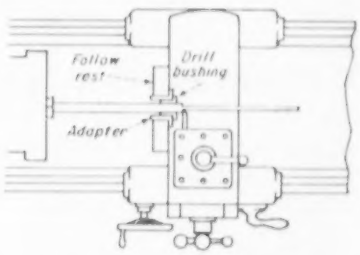
When changing a press over from punching to drawing work, you often have to make a special arrangement under the bolster to operate the ejector pin in the drawing die. To eliminate this bother, we have installed a permanent pad ring and removable tapered plug.

The ring is bolted to the under side of the bolster, where strong compression springs support it. With the plug in position, and with an ejector pin working in the die, the pad works up and down to operate the ejector. About 1/64 in. clearance between the plug and the rebored bolster hole is required.

If a punching die is in place, the tapered plug is removed to allow slugs to drop through the tapered hole in the ring, as is normal.

This arrangement also has another advantage: The plug fills up the bolster hole to the top, so the ejector pin can be fairly short. In fact, all drawing dies can be standardized, with ejector pins only extending down below the die by the amount of ejector stroke required for each job.

Walter Kalinowski, Elizabeth, N J



Drill Bushing In Followrest Allows Slender Turning

A considerable amount of 3/16-in. rods had to be reduced to 1/16-in. over a length of 5 in. This presented quite a problem, and here is our solution to it: After mounting our followrest in position, and setting the jaws a little under 1 in., we bored them concentric by colleting a 1-in. end mill in the headstock and feeding the followrest into it.

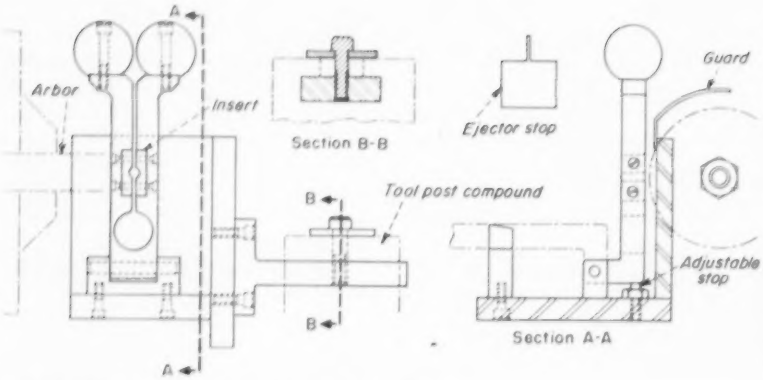
A shoulder adapter was made to fit the followrest and take a commercial 3/16-in. drill bushing. If no follower is available, a substitute can be constructed from a piece of heavy steel plate. In turning, set tool close to the bushing (1/16 of an inch or less) and adjust it to turn to finished size in one pass using a fine feed. Oil should be applied generously, both as a lubricant for the bushing and as a coolant for machining.

R J Lemp, Sayville, N Y

Squeegee Cleans Chuck

Instead of using waste, rags, or paper in cleaning off the magnetic chuck on a surface grinder, try a squeegee, of the variety used by housewives to clean windows. It will remove coolant and abrasive dust with little effort.

Henry George, Yonkers, N Y

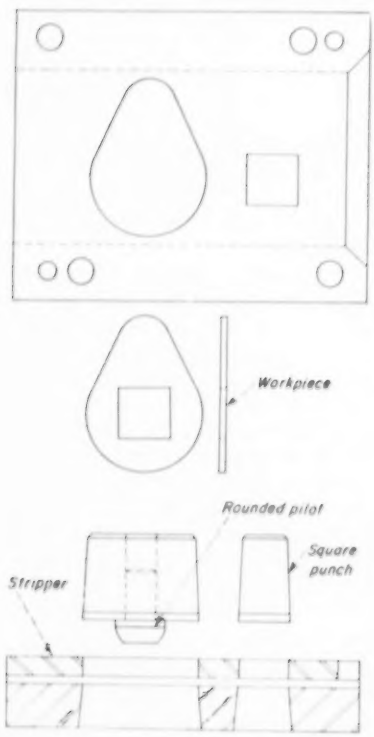


Slotting Parts Made Easy

We had an order to slot a large amount of special parts and screws, so we had to figure a way of holding them.

An angle plate was first constructed, on which we mounted the lever and stops. In the gripping section are removable jaws, so different size or shape parts can be held. The other side of the angle plate is slotted to clear the saw, and is fitted with a guard. It is mounted in a small lathe via a compound bracket that can be removed if we would like to use the fixture in a drillpress, while lathe is occupied.

J Mangano, New York, N Y



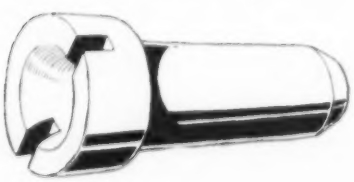
Floating Hand Punches Pierce Accurate Blanks

The stripper plate on this die set locates the piercing and blanking punches, but a rounded pilot is necessary to align the pierced stock so it will be blanked accurately.

Stock is moved in to the edge of the blanking hole, and the central hole is pierced first. Then the stock is moved over, and the pilot is used to pick up the pierced hole, which aligns the stock for the blanking stroke.

This is progressive stamping for low-production work. The pickup pilot makes it unnecessary to build a second die and to handle the stamping stock a second time, as would otherwise be required.

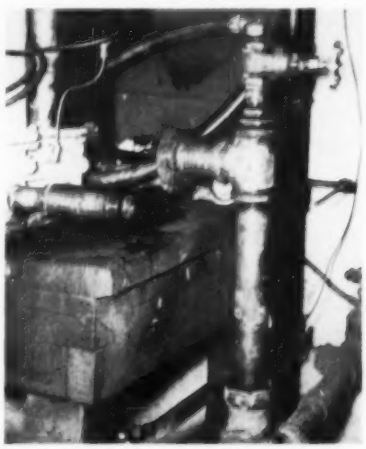
J Mangano, New York, N Y



Slotted Bushing Saves Small Drills

Number-size drills used through bushings are most likely to break if a chip or shaving comes up through the bushing and binds the drill. One way to minimize this waste is to slot the head of the bushing, as shown, so the chips are broken up more readily. The slot also acts as a pocket for cutting oil, which should help the operation. This slotted bushing is only recommended for a power drilling setup where the drill is accurately aligned with the bushing at all times.

John R Burns, Dayton, O



Dresser Coupling Cuts Plumbing Work In Pump Testing

We get a large assortment of pumps to repair in our shop. They vary widely in capacity as well as construction. It is therefore a time-consuming and wasteful job to pipe up each individual pump for testing, after they have been repaired.

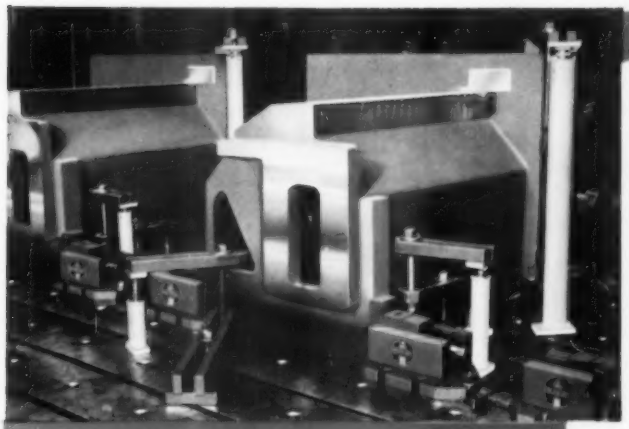
It was for these reasons we equipped our test bench with a dresser coupling over a sliding pipe. Hooked in vertically on the water-supply line, it enables us to make all connections regardless of location of the pump intake.

If a pump to be tested has intake at the bottom, we make use of a welded pipe stand. The pump is placed on this stand and connection is made with an elbow.

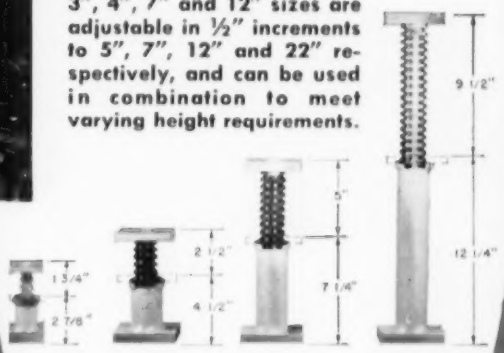
All pumps do not have the same size intake, so we keep a small assortment of reducing fittings on hand to handle all situations.

After proper hookup has been made on the pump under test, we loosen the dresser coupling and adjust the sliding pipe to right height. We connect union fitting and tighten nut, then we tighten the dresser coupling nut and proceed to test.

Harry J Miller, Sarasota, Fla



Ingersoll Clamp Posts are used with hold-down clamps to keep work rigidly in position. Easy to handle, they are raised by simply lifting and turning the stem. Standard 3", 4", 7" and 12" sizes are adjustable in ½" increments to 5", 7", 12" and 22" respectively, and can be used in combination to meet varying height requirements.

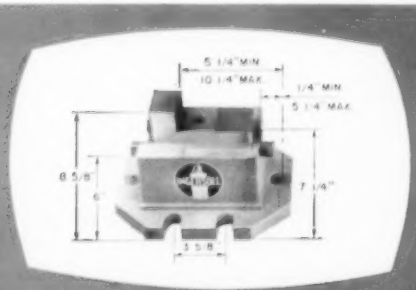


3"-$6.75 4"-$8.50 7"-$12.00 12"-$15.00

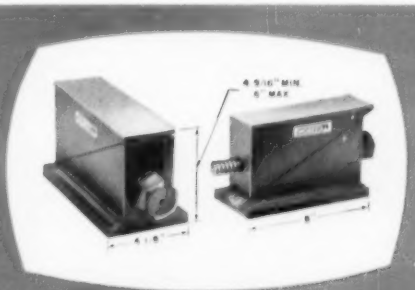
INGERSOLL Setup Aids

Save Time in Milling, Boring, Planing, Drilling

You'll get quick and easy machine setups if you replace makeshift, inefficient equipment with Ingersoll Setup Aids. Developed to help hold and support workpieces during machining operations, they can be used on almost all kinds of machines. Standard sizes shown are immediately available from stock. Information on special sizes will be sent upon request.



Ingersoll Chuck Jaws — hardened steel jaws mounted in a cast iron base — hold work securely in place during machining. Workpieces can be positioned accurately because surfaces are manufactured to close tolerances. Standard size — $165 each.



Ingersoll Adjustable Parallels provide a firm, stable footing for workpieces. Inclined plane feet made of steel are easily adjustable by means of heat-treated alloy steel screws. Standard size — $65 each.

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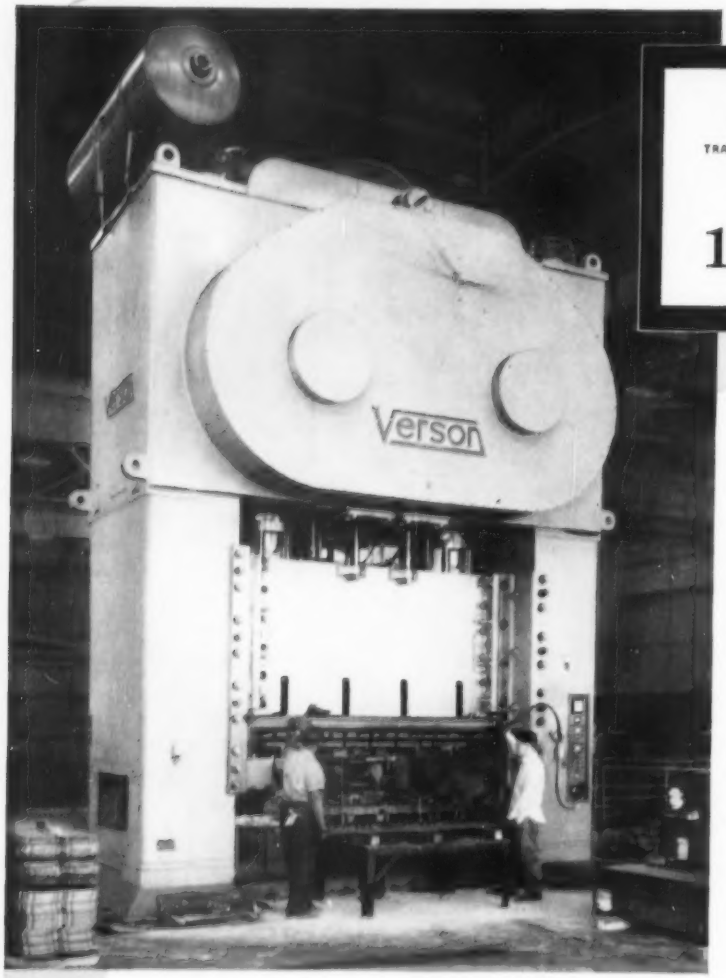
BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

Front to Back Crank Arrangement of this

TRADE **Verson** MARK

1800 Ton Press



eliminates need for extra long shaft

Verson Presses offer features that bring accuracy, dependability and economy to a wide range of metal forming operations. The Verson Allsteel Frame, anti-overlap clutch and brake unit, square type gibs and non-oscillating vertical type adjusting screw are examples of the engineering and design that are a part of every Verson Press.

The press illustrated is a Verson 1800 Ton, twin gear, double crank. Two crankshafts are arranged front to back to eliminate the necessity of an extra long crankshaft. Gearing for the press can be installed and removed through the front of the crown allowing installation in areas with low overhead clearance. The machine was built to J.I.C. standards and has all electrical wiring and equipment, lubrication piping, air piping and controls installed internally.

We will be pleased to recommend Verson Presses to fit your production process. Just send an outline of your requirements.

A Verson Press for every job from 60 tons up.

TRADE **Verson** MARK

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American Machinist **REFERENCE BOOK SHEET**

Aluminum-Base Die-Casting Alloys — I

These standard and special alloys have been coded by the American Die Casting Institute, New York. For cross-references to similar alloys standardized by other groups, see the chart on page 159.

Standard alloys provide commercially satisfactory combinations of properties and characteristics at lowest cost. Special alloys are available at higher costs for applications involving certain specific requirements and should be specified only when necessary for the end use involved. For example:

Alloy 360, SG100B, provides somewhat better ductility and corrosion resistance than either of the standard alloys.

Alloy 39-11, SC114A, has excellent fluidity or die-filling capacity which is of advantage in producing large, thin-walled, intricate die castings.

Alloy 218, G8A, provides the best combination of strength, ductility,

Standard Alloys—Chemical Composition and Properties

Designation	Standard Alloys*	
Commercial ASTM	13 S12B	380 SC84B
Composition-per cent (1)		
Copper	0.6	3.0-4.0
Iron	2.0	2.0
Silicon	11.0-13.0	7.5-9.5
Manganese	0.35	0.50
Magnesium	0.10	0.10
Zinc	0.50	1.0
Nickel	0.50	0.50
Tin	0.15	0.35
Aluminum	Remainder	Remainder
Properties and Constants (2)		
Tensile strength psi	36,000	43,000
Yield strength (0.2% offset) psi	21,000	25,000
Elongation, % in 2 in.	2.0	2.0
Shear strength, psi	25,000	28,000
Fatigue strength, psi (3)	19,000	20,000
Specific gravity	2.65	2.71
Weight per cu in, lb.	0.096	0.098
Melting point (liquid), F.	1080	1100
Thermal conductivity, CGS	0.29	0.23
Thermal expansion, in/in/°F (4)	11.9	12.1
Electrical conductivity, % of copper	31	23

(1) Composition in per cent, maximum, unless shown as range. Same as ASTM B85.
(2) Data furnished by Aluminum Company of America and ASTM B85. Revisions are in progress.
(3) R.R. Moore rotating beam test data at 500,000,000 cycles.
(4) To be multiplied by 10^{-6}. Temperature range 68 to 392 F.
*These standard alloys are also available with 1.5% maximum iron content (designated 13X and A380) having 3% elongation.

Special Alloys—Chemical Composition and Properties

Designation	Special Alloys			
Commercial ASTM	360* SG100B*	39-11 SC114A	218 G8A	43 S5C
Composition-per cent (1)				
Copper	0.6	3.0-4.5	0.25	0.6
Iron	2.0	1.3	1.8	2.0
Silicon	9.0-10.0	10.5-12.0	0.35	4.5-6.0
Manganese	0.35	0.50	0.35	0.35
Magnesium	0.40-0.6	0.10	7.5-9.5	0.10
Zinc	0.50	1.0	0.15	0.50
Nickel	0.50	0.50	0.15	0.50
Tin	0.15	0.35	0.15	0.15
Total Others	0.25	0.50	0.25	0.25
Aluminum	Remainder	Remainder	Remainder	Remainder
Properties and Constants (2)				
Tensile Strength psi	43,000	43,000	41,000	30,000
Yield Strength (0.2% offset) psi	25,000	27,000	27,000	16,000
Elongation, % in 2 in.	3.0	2.0	7.5	5.0
Shear Strength, psi	27,000	28,000	28,000	19,000
Fatigue Strength, psi (3)	19,000	19,000	23,000	17,000
Specific Gravity	2.63	2.70	2.57	2.65
Weight per cu. in., lb.	0.095	0.098	0.093	0.096
Melting Point (Liquid), F	1105	1080	1150	1170
Thermal Conductivity, CGS	0.27	0.23	0.23	0.34
Thermal Expansion, in/in/°F (4)	12.2	11.7	13.9	12.9
Electrical Conductivity, % of Copper Standard	29	23	24	37

(1) Composition in per cent, maximum unless shown as range. Same as ASTM B85.
(2) Data furnished by Aluminum Company of America and ASTM B85. Revisions are in progress and will be made from time to time.
(3) R.R. Moore rotating beam test data at 500,000,000 cycles.
(4) To be multiplied by 10^{-6}. Temperature range 68 to 392 F

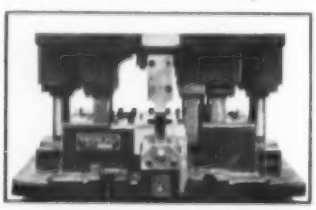
*This alloy is also available in lower iron composition, A360.

1

Part as received by customer. Note roll-formed box section:

2

One end flattened, in die set-up shown.



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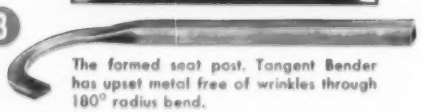

The formed seat post. Tangent Bender has upset metal free of wrinkles through 180° radius bend.

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American Machinist REFERENCE BOOK SHEET

Aluminum-Base Die-Casting Alloys — II

corrosion resistance and finishing qualities but is more difficult to die cast.

Alloy 43, S5C, is sufficiently ductile for special applications requiring forming or upsetting during assembly operations but is difficult to die cast.

Selection of an aluminum-base alloy for a die casting requires evaluation not only of physical properties, constants, and chemical composition, but also of the effect of the alloy on production of the die casting and in finishing.

The table of characteristics includes certain casting and other outstanding characteristics which are usually considered in selecting a die-casting alloy for a specific application. The characteristics are rated from (1) to (5), (1) being the best and (5) being the least desirable alloy. In applying these ratings, it should be noted that all the alloys have sufficiently good characteristics to be accepted by users and producers of die castings. Hence a rating of (5) indicates a commercial alloy, although in certain cases its application may be limited or its manufacture may be restricted to relatively simple die castings.

Characteristics of Aluminum-Base Die-Casting Alloys

		Die Casting Characteristics						Other Characteristics(k)				
Alloy	Approximate Melting Range °F	Resistance to Hot Cracking (a)	Pressure Tightness	Die-Filling Capacity (b)	Anti-Soldering to the Die (c)	Resistance to Corrosion (d)	Machining (e)	Polishing (f)	Electroplating (g)	Anodizing (h) (Appearance)	Chemical Oxide Coating (i) (Protection)	Strength at Elevated Temp (j)
Standard												
13, S12B 13X, S12A	1065 — 1080	1	1	1	1 3	3	4	5	3	5	3	3
380, SC84B A380, SC84A	1000 — 1100	2	2	2	1 2	4	3	3	1	3	5	2
Special												
360, SG100B A360, SG100A	1035 — 1105	1	1	1	2 3	2	3	3	1	3	3	2 1
39-11, SC114A	960 — 1080	2	2	1	3	4	3	3	2	4	4	2
218, G8A	995 — 1150	5	5	4	5	1	1	1	5	1	1	4
43, S5C	1065 — 1170	2	3	3	4	3	5	4	2	2	3	5

(a) Ability of alloy to withstand stresses from contraction while cooling through hot-short or brittle temperature range.

(b) Ability of molten alloy to flow readily in die and fill thin sections.

(c) Ability of molten alloy to flow without sticking to the die surfaces. Ratings are given for both iron compositions for 13, 13X; 380, A380; and 360, A360.

(d) Based on resistance of alloy in standard type salt spray test.

(e) Composite rating based on ease of cutting, chip characteristics, quality of finish, and tool life.

(f) Composite rating based on ease and speed of polishing and quality of finish provided by typical polishing procedure.

(g) Ability of the die casting to take and hold an electroplate applied by present standard methods.

(h) Rated on lightness of color, brightness, and uniformity of clear anodized coating applied in sulphuric acid electrolyte.

(i) Rated on combined resistance of coating and base alloy to corrosion.

(j) Rating based on tensile and yield strengths at temperatures up to 500 F, after prolonged heating at testing temperature.

(k) Die castings are not usually solution heat treated. Low-temperature aging treatments may be used for stress relief or degrowthing. Die castings are not generally gas or arc welded or brazed.

A
ROTOR
When a manufacturer of hydraulic pumps switched from 8620 steel to Copperweld 8620 Leaded Steel, the life of a set of tools was increased 33⅓% from 7200 pieces to 9600 pieces.
A
Q
KNOCKOUT PUNCH
When the Greenlee Tool Company switched to a Copperweld Leaded Alloy for this knockout punch, their spindle RPM on operations involving turning, drilling, milling and grinding increased 30%, and their tool feed from .005" IPR to .009" IPR.
Q
GEAR
This complex gear, part of the gear assembly for The Frank G. Hough Company's "Payloader," is made in 6 separate operations or set-ups with a tooling sequence of 13 operations. When they switched from unleaded steel to Copperweld Leaded 8620, the faster feeds and speeds gave them a production increase of better than 25%. In addition, tool life increased 60%.
K

It's in the cards to save time and money with

COPPERWELD LEADED ALLOYS

ARISTOLOY STEELS

Case after case where manufacturers use Copperweld Leaded Alloy Steels—the steels with "built-in productivity"—substantial savings are realized. When your problem is quality work in quantity production, leaded steels give faster feeds and speeds and their machinability can increase tool life 60%.

Write for free booklet, "Lead Treated Steels."

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EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

American Machinist **REFERENCE BOOK SHEET**

Cross-Reference Charts for Die-Casting Alloys

These charts have been prepared by the American Die Casting Institute, New York, to provide a means of identifying the commercial-alloy designation of a die casting from the alloy designation appearing in Government or other standard specifications

Zinc Base Alloy Die Castings

COMMERCIAL DESIGNATION			
NOMINAL COMPOSITION			Al 4%
Symbol	Specifying Organization	General Spec. No.	DESIGNATION USED IN SPECIFICATIONS
ASTM	American Society for Testing Materials	B86	AC41B
SAE	Society of Automotive Engineers		903 925
FED	Federal Specifications	QQZ363	A B
AMS	Aeronautical Materiel Spec.	4803	

Aluminum Base Alloy Die Castings

COMMERCIAL DESIGNATION			13*	380*	360*	218	39-11	43
NOMINAL COMPOSITION			Si 12%	Cu 3.5% Si 9.0%	Mg 0.5% Si 9.5%	Mg 8%	Cu 3.8% Si 11%	Si 5%
Symbol	Specifying Organization	General Spec. No.	DESIGNATIONS USED IN SPECIFICATIONS:					
ASTM	Amer. Soc. for Testing Matls.	B-85	S12A S12B	SC84A SC84B	SG100A SG100B	G8A	SC114A	S5C
SAE	Society of Automotive Engineers		305	306 308	309		303	304
FED	Federal Specifications	QQA-591a-1	Comp No. 1 Comp No. 2	Comp No. 10 Comp No. 11	Comp No. 12 Comp No. 12A	Comp No. 7		Comp No. 3
MIL	Military Specifications	MIL-A-15153a	Class 1	Class 10	Class 9	Class 7		Class 3
AMS	Aeronautical Materiel Spec.		4292	4291A-2	4290E			
AF	Air Force	MIL-A-8294	Comp No. 1		Comp No. 2			

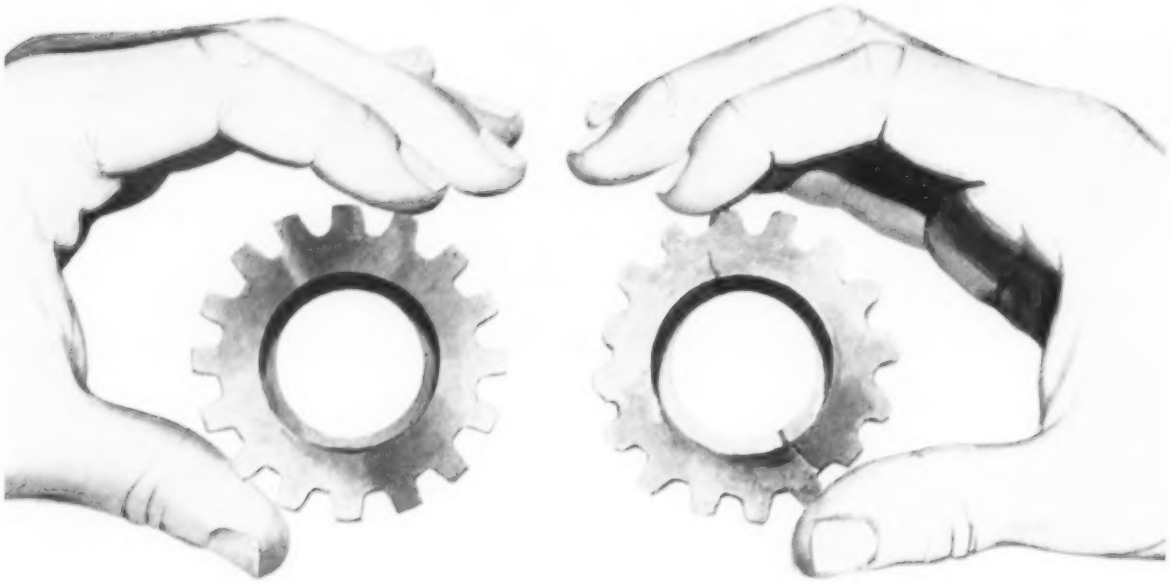
* These alloys are available in two grades with different iron-analysis levels. See succeeding pages. The lower iron grades are commercially designated 13x, A380 and A360

Magnesium Base Alloy Die Castings

COMMERCIAL DESIGNATION			AZ91A	AZ91B
NOMINAL COMPOSITION			Al 9% Zn 0.7%	Al 9% Zn 0.7%
Symbol	Specifying Organization	General Spec. No.	DESIGNATION USED IN SPECIFICATIONS	
ASTM	American Society For Testing Materials	B94	AZ91A	AZ91B
SAE	Society of Automotive Engineers		501	501A
FED	Federal Specifications	QQ-M-38	only	
AMS	Aeronautical Materiel Specs	4490D	only	

Copper Base Alloy Die Castings

COMMERCIAL DESIGNATION	Z30A	ZS331A	ZS144A
NOMINAL COMPOS.	Cu 60%	Cu 65% Si 1%	Cu 81% Si 4%
General Spec. No.	DESIGNATION USED IN SPECIFICATIONS		
B-176	Z30A	ZS331A	ZS144A



"What's wrong? They're both 8620 alloy steel!"

A Baltimore manufacturer was working on an order for oil pump gears of 8620 alloy steel. The first lot of steel attained satisfactory core hardness—but the second lot would not meet minimum hardness requirements.

Both lots were bought from a reputable source. What went wrong?

The same alloy, sure—but different heats!

The manufacturer ran into trouble because the chemical composition and hardenability of different furnace heats of the same alloy can and do vary (within AISI and SAE limits) enough to have a marked effect on heat treatment response. As a result of such variation, the "right" alloy failed.

Here's why this can't happen with Ryerson alloys

Unfailing protection against the hazards of varying properties and hardenability is always yours when you specify and buy Ryerson certified alloys. That's because we test *your particular lot of steel* for heat treatment response, verify its chemical composition—and give you a record of these tests, keyed to the identification symbol on the steel.

So there's no guesswork—no need to rely on *typical* hardenability figures for your type of steel. With Ryerson certified alloys you know the *actual*, proved hardenability of the steel.

This extra assurance of quality doesn't cost you a cent—and it's only part of an 8-step quality control program to prevent the breakdown of equipment, the scrapping or reworking of rejects that may result when you're not sure of the alloys you buy. So next time—order Ryerson certified alloys and be sure.

RYERSON STEEL

In stock: Bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing bars, machinery & tools, etc.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Talking Shop . . .

Ergometry Again

DOCTORS have taken up ergometry (scientific measurements of energy capacity of the worker and energy requirements of the job) as a better way to approach rehabilitation and initial job placement. It would replace "flying by the seat of our pants," as one doctor put it in a Cleveland meeting of the AISI. The technique will become particularly important as average age of workers increases (as it has been doing), and the number of physical impairments goes up with it. Savings in money, manpower, and human dignity will accrue. The science has thus far reached greatest application in Scandinavia, but has been purely for measurement of work capacities of the physically fit.

Flying Lab

HUGHES AIRCRAFT COMPANY, Culver City, Calif, has used an unusual technique to test its control system for jet interceptors (see News, July 2 *AM*). It flies a "plane within a plane." The radar system for the new F-102 interceptor is installed in the cabin of a T-29, military adaptation of the Convair 240 airliner, even to a pilot's cockpit, checking and test equipment, plus half a dozen engineers. The regular pilot takes the T-29 up, then transfers control to the test pilot in the cabin cockpit—and the engineers can check everything while he flies the plane, with no pressure suits to hamper their work.

Die-cast Pen

BALL-POINT PEN TIPS are now being die-cast in a tin alloy, on a cycle of less than a second. Tips require no finishing.

Ceramic Wear Surface

MORSE CHAIN CO, Ithaca, NY, has been testing a ceramic toolbit as a wearpiece in a wire cutoff machine. The wire comes against the bit as a stop, is then sheared by a wiping arm that thus rubs the stock against the stop. When carbide was used, it lasted only two hours under the abrasion. A Sintox bit, brazed on, lasts six and costs less initially.

Weldable, Too

TESTS ON WELDABILITY of the new 200 series of stainless-steel grades show easy welding by any common method. In tests on 16-gage sheet, grades 201 and 202 chrome-manganese stainless closely resembled the well-known 301, 302 and chrome-nickel grades. Allegheny-Ludlum's research labs show slightly higher tensile and yield strengths, elongation and bend angles for the 200 series. In automatic inert-arc welding, higher beat or slower welding speed was required, but clean welds were produced easily. Present tests are on weldability of plate materials.

Part Sling

NICKS AND SCRATCHES on finished parts dropping from machines can be avoided this way: Nail a piece of belt leather across the top of a wooden tote box, leaving a couple of inches of sag in the center. Position the box so the parts fall onto the leather, then bounce off with reduced force into the box.

Hydraulic Tip

DO NOT RUN hydraulic equipment, as in machine tools and automated equipment, at peak permissible pressures—for example, 1000 psi. Use instead oversize equipment that provides required thrust at 250 to 300 working psi. You get smooth working action, avoid trouble from leaks, and long life, according to Ford engineers.

Robot Settles Arguments

SCULLY-JONES & CO., Chicago, are using a Carboloy machinability computer to figure machining standards. One part that, on former trial-and-error standards, took 244 min, now is done in 166.2 min. The computer is checking present standards, correcting discrepancies, resolving debates between operators, and developing new standard times. The emphasis at Scully-Jones is on output rather than tool life because of short runs, according to Erwin Kambeitz, chief standards engineer.

Ceramics Score Again

SAID TO HAVE a purer tone than can be obtained from metal, a 41-bell porcelain carillon has been installed in the city of Lueneburg, Germany, to celebrate the city's 100th anniversary. The bells were fired by a secret process and cut to size and tone with diamond tools.

British Ceramic

OUR BRITISH FRIENDS have held back on ceramic toolbits a bit, from reports—and have looked with a slightly superior air at our enthusiasm. The first British producer has sold his entire year's output to the US (*AM*—June 4 '56, p169). But now Wickman, well-known lathe maker, has surprised his compatriots by showing a new ceramic on his machines at the Olympia Exhibition—one he developed himself.

Throwaway Tap?

SMALL-DIAMETER TAPS are seldom resharpened and used to full life. In most cases, they are broken or discarded after only 25 to 30% of their useful life has been achieved. Thus why make the threaded portion any longer than necessary for that amount of life? This is the question of one big user, who finds that it costs more to resharpen small taps than it does to buy new ones, at present labor rates (see *AM*—May 7 '56, p154). His suggestion is that the sizes under 1/4-20 be explored first for possibilities of redesign to create a cheaper throwaway tap.

News of Metalworking . . .

Rapidly Growing Soviet Machine Tool

. . . an exclusive London interview with Russia's Minister of Machine Tools and Small Tools by

BURNHAM FINNEY
Editor, American Machinist

LONDON, JULY 1—The Russian machine tool building industry is three times as large in production facilities today as it was 10 years ago immediately following World War II. Its output in 1956 is expected to be 250,000 tons of machine tools. If the present 5-year plan's objective is achieved, the Soviet Union's manufacture of machine tools in 1960 will be at least double the present volume and perhaps even more.

Interview at Olympia

These statements were made to me in an exclusive interview by A I Kostousov, Minister of Machine Tools and Small Tools of the Union of Soviet Socialist Republics, who is heading a party of 20 Soviet technicians visiting the International Machine Tool Exhibition at Olympia on the invitation of the Machine Tool Trades Association of Great Britain, organizers of the Olympia Show.

The size of Russia's machine tool production this year can be gaged by the weight comparison with other machine-tool-building nations. While Russia is turning out 250,000 tons of machines, the British industry will be producing around 150,000 tons. No exact figures are available for West Germany, but it is believed that the Soviet production exceeds that of Dr. Adenauer's country. It is possible that Russia's output, on a weight basis, may even be larger than that of our own in the United States.

For the sake of accuracy, however, one should know that these comparisons are only rough at best. I am not sure that the figure given me by Mr Kostousov includes the identical categories counted by other countries in arriving at their overall machine tool total. The Russian production—250,000 tons—includes metal-cutting machine tools, forging machines and presses.

Mr Kostousov made clear the fact that despite Russia's expansion of machine tool production, it will need to import machine tools from other nations if it is to meet its 5-year plan objectives in production of metal goods of all kinds. He cited the statement of Mr Krushchev, during the latter's recent visit to England, that Russia would like to buy machine tools from Great Britain "on the basis of mutual benefit." The Russians submitted to the British during Mr Krushchev's visit a so-called "shopping list" of machine tools that they desire to buy in 1956-1960. The list totals $100-$125 million and includes large numbers of transfer machines (see AM June 4, 1956, p111).

Machine tools are being imported into the Soviet Union "on an exchange basis" from Czechoslovakia, which has a long-standing well-developed machine tool industry; from East Germany, which has a fairly large machine tool industry; from Switzerland, and other western European nations. Russia has been securing machines from all of these countries for several years. However, its importation of machines from NATO countries has been limited to certain types of so-called nonstrategic machines. Machine tools on the critical list, especially "elephant tools", cannot be shipped to eastern European countries or to China by any member of NATO.

Some Are for Replacement

Explaining that his activities encompass only the production of the machine tools required by Russia's metalworking industries, Mr Kostousov said that he is not in a position to know how much of Russia's machine tool production and its machine tool imports are going into replacement of old equipment in existing plants and how much into brand-new facilities. He told me, however, that the bulk of the machine tools are being installed in the heavy-goods industries. He also said that a considerable portion of current output of machine tools is being allocated to the machine tool building industry itself in an effort to enlarge its capacity and to carry out the current 5-year plan. To further the program for expanding the facilities of the Russian machine tool industry, Soviet authorities would like to bring in from outside some 7000 machine tools this year.

Needing as many machine tools as it does, Russia is exporting relatively few machine tools, Mr Kostousov said. These are mostly on a trade agreement exchange basis with other countries, mostly those within the Communist bloc. He predicted that in the years immediately ahead Russia would have only a very small number of machine tools available for export to the western world. On the strength of Mr Kostousov's statement, I take it that Russia will not become a serious contender for machine tool business in world markets during the next five years.

Mr Kostousov proudly declared to me that Russia now is in a position to build all types of machine tools. It is manufacturing elephant tools as well as producing standard machine tools on an assembly-line basis. The Minister scoffed at my suggestion that perhaps shortage of manpower is a troublesome factor in the Soviet machine tool building industry. He pointed to the observations of the American engineers who recently visited Russia (Messrs Bean, Brandt and Hall) that the Soviet is turning out technicians from its schools at a very impressive rate. He intimated, though he did not make a direct statement on the subject, that if manpower became short in the machine tool industry and machine tools became a critical bottleneck to Soviet metalworking operations, the government would take a hand to see that the necessary men were available.

Soviet metalworking plants have been using ceramic tools for some time—to such an extent that hundreds of thousands of these tools are being made this year. Ceramic tools are being employed mostly on turning work and other operations that do not take severe shocks. The ceramic bits are inserted in holders or cemented into work positions. Little if any brazing of ceramic tools to the holders is being done. Mr. Kostousov said that ceramic tools have been under intensive development in Russia for the past 5 years. The mechanical properties of these tools

Output Challenges U.S. Leadership

still are a source of study to overcome certain deficiencies.

The delegation headed by Mr Kostousov is at Olympia for the purpose of seeing what's what in latest machine tool developments in the western world. It disclaims any authority to place orders, saying that the buying of machine tools is the responsibility of another Ministry. Nevertheless, it is a good guess that its recommendations will carry a lot of weight in the selection of the machines to be ordered.

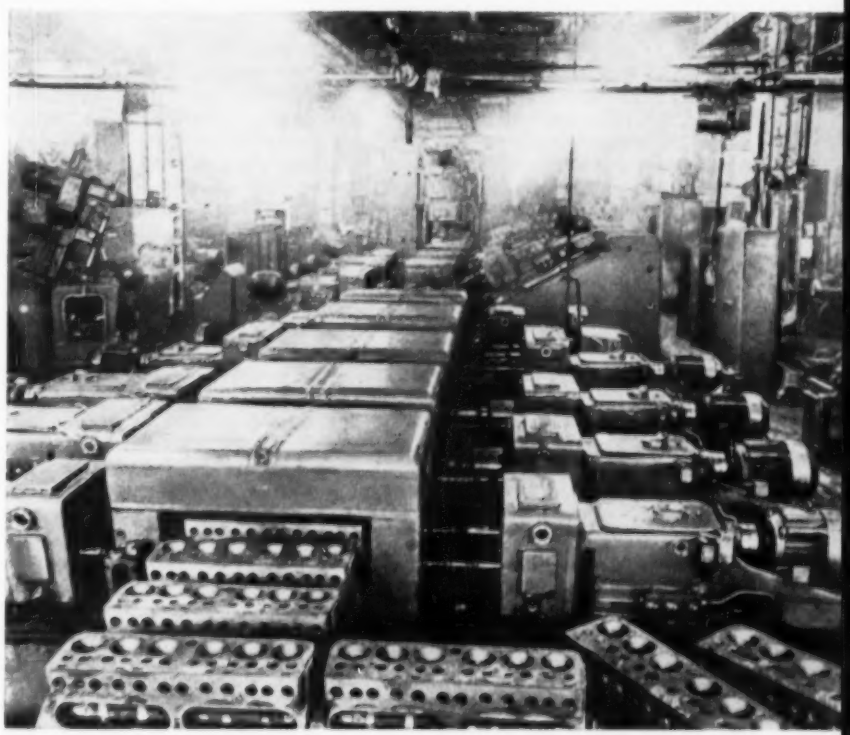
Buying Mood at Olympia

Moreover, some machine tool builders—not the British alone but Americans as well—report that the Russians have approached them informally with offers to take many of the machine tools on display. The truth is that most machines are earmarked for delivery to certain customers who agreed to delay a bit taking delivery so that the machines could be displayed at Olympia. Beyond that, many of the machines desired are on the full or partial embargo list.

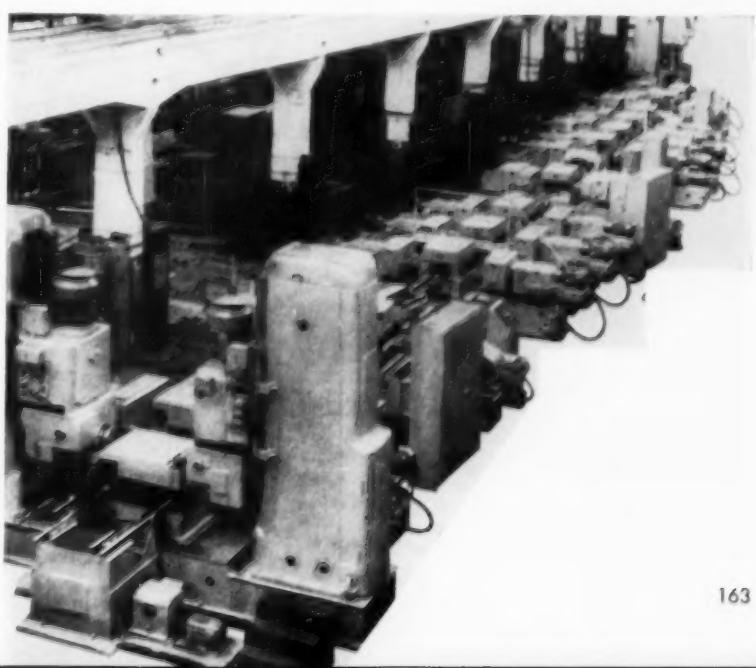
Mr Kostousov said that his country would welcome a visit from a team of technicians from the British machine tool industry, a team comparable in makeup to his own. (British machine tool leaders emphasize that the invitation to the Russians was nothing more or less than to see the Olympia Show. It did not constitute the beginning of an exchange of technical information between the Russian and the British machine tool industries.)

Soviet authorities are definitely interested in purchasing machine tools in the United States, Mr Kostousov revealed. He said that the time has come to remove the embargo that now is in effect on shipments of critical machine tools to eastern Europe. If such action were taken, Mr Kostousov declared that Russia would place orders for substantial quantities of machine tools with U.S. builders. But such trade would have to be established on a mutual exchange basis.

Pressed for an interpretation of what he meant by mutual exchange, Mr Kostousov refused to go beyond the broad statement that Russia



Detroit-like transfer machines . . .
developed by Russia's Ordzhonikidze Machine Tool Factory provide a graphic idea of just how far the not-so-long-ago-backward Russian machine tool industry has come along the road to full automation. These multi-station transfer machines turn out tractors in a Moscow plant



SOVIET TOOLS (continued)

would pay for her machine tool purchases by shipments of raw materials and manufactured goods.

Mr Kostousov asserted that his government would welcome an invitation to send a delegation from Moscow to visit machine tool building plants in the United States. He said that his government in return would be happy to welcome a group from the U.S. machine tool industry to see for themselves what the Russian machine tool industry is like. He referred to the successful exchange of visits by farming experts of the two countries last year.

(I should say that at this point, particularly in an election year and with public opinion what it is, the chances are virtually zero that Washington will look with favor on either a relaxation of the ban on shipment of critical machine tools to eastern Europe or an exchange of visits by Russian and US delegations to the machine tool industries of the two countries).

The Russian delegation will be in Britain about three weeks. In addition to doing the Olympia Show thoroughly, Mr Kostousov and his group are visiting a number of British machine tool building plants.

IBM Ships First "SAGE" Computer: Shows New Electric Typewriter Plant

KINGSTON, NY—With the help of such advanced equipment as the General Mills "Autofab" automatic electronic assembly machine, which can insert 1 to 24 electronic components on a printed circuit card and produce 20 assemblies per minute, IBM has completed the first of the large-scale computers for the nation's vast, new electronic air-warning network. This extraordinary, giant, "electronic brain" is designed to fit into the integrated complex of radar, ships, jet aircraft, communications networks, missiles, and people that is rapidly taking shape as the supersensitive continental air defense system. The first unit will be installed at McGuire Air Force Base.

Something of the immensity of this project can be realized when one learns that these computers are being built, or assembled, one at a time, requiring all of the nearly 400,000 sq ft of floor space in this new plant and about 3000 employees. Designed by IBM's Military Products Div Laboratory at Poughkeepsie, NY, in cooperation with the MIT Lincoln Laboratory, the computer is manufactured at the Kingston Military Products Div plant.

Decentralized Manufacturing

Following the principles of decentralized manufacturing, a second new plant adjacent to that used for military products houses the IBM Electric Typewriter Div. This 342,000 sq-ft building is said to be the world's largest electric typewriter assembly factory. Employees number 1800. While most of the components are still produced by the Poughkeepsie plant, finishing, assembly, and inspection are done at Kingston.

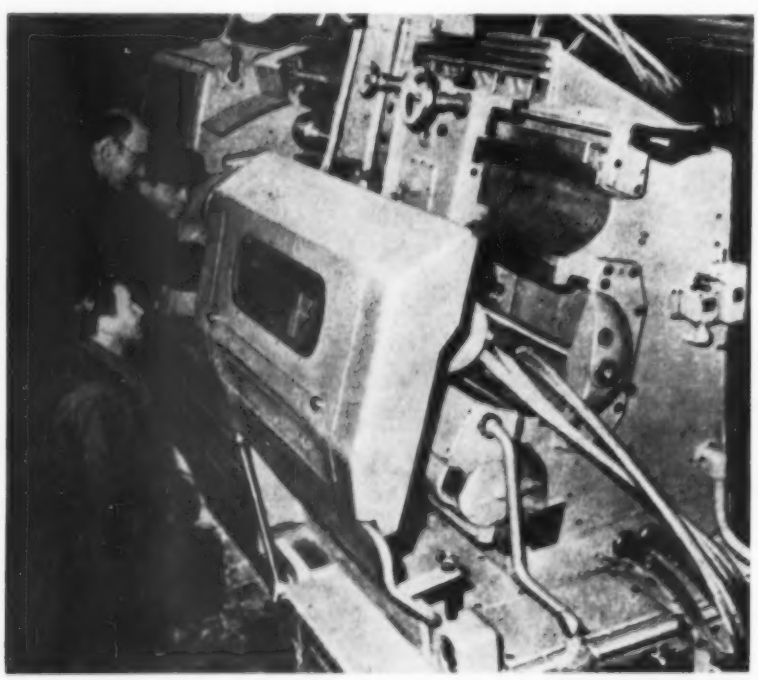
Automatic Assembly

Assembly techniques used at Kingston emphasize automaticity and advanced handling methods. Two miles of various designs of overhead, roller, and belt conveyors speed parts, sub-assemblies, and in-process typewriters to most assembly points. Conveyors permit active in-process storage between operations.

Automated Electroplating

Automation is evident in electroplating typewriter parts. Equipment used for this task was developed for IBM and has never been used in industry. The entire operation of plating with nickel, cadmium, and chromium is controlled by one man at a master console. One-man operation will also be utilized for automatic mechanical finishing, including deburring and polishing by barrel tumbling using a controlled program assigned to each part.

Nestled in the Catskill Mountains on the outskirts of Kingston, both plants are attractive and efficient. Office space and portions of the typewriter plant have acoustically treated ceilings, and 50 foot-candle lighting is supplied in both office and manufacturing areas. Maple-block flooring is used throughout manufacturing areas, and asphalt tile in the cafeteria and administrative areas. Both plants are air conditioned and parking facilities are provided for 3500 cars.



HYDRO-COPYING MILLING MACHINES like this one, shown for the first time outside Russia this year, are another indication of the tremendous technological surge the Soviet Union has taken since World War II

BRITAIN'S OLYMPIA SHOW:

1500 Machine Tools Make an Impressive Showing for Western Europe

LONDON — Britain's International Machine Tool Exhibition at Olympia, London, is an impressive one this year—with all the Western European nations represented—and a few Iron Curtain countries, too.

Plenty of New Developments

Metalworkings new trends and developments are much in evidence —such as automatic handling of parts in and out of machines, although not to the same degree as in last year's Machine Tool Show in Chicago. Ceramic tooling is a hot topic among Metalworking people attending Olympia. The British take a characteristically cautious view of what they recognize to be a potentially significant trend. Britain's Wickman is demonstrating its own ceramic material for the first time, but its ceramic tools aren't for sale yet. And Firth-Brown Tools has announced experiments with ceramic tools.

Other developments of interest shown at Olympia:

• **BRITISH:** Two British builders, H W Kearns and Newall, are using British Thomson Houston positioning controls. Unit is operated by hand-set dials for six digits, or by punched card.

Coventry Gage & Tool machine has a Mullard electronic positioning unit running on a different principle—the setting can be made to 0.0001 in.

British Ferranti is showing a CVA-Kearney & Trecker milling machine controlled automatically by Ferranti's electronic unit.

British Controls on U S Machines

British controls are applied to two U S machines shown at Olympia: (1) an EMI (British) electronic unit controls a Cincinnati Milling punched-tape controlled machine, and (2) a British BTH electronic unit controls a Giddings & Lewis horizontal boring machine for copy milling.

Britain's Drummond has an electronic-type copy-turning production lathe.

David Brown is introducing a range of bevel gear machines, including spiral bevel and hypoid generators for gears up to 18-in. dia by 2.5 DP, and a roughing machine for gears up to 13 in. dia, 5:3 DP.

Newall has unveiled a crackshaft pin grinding machine with fully automatic handling of work into and out of the machine. Dressing of the side face, radii and periphery is done at one pass on new principle. Pin diameters are controlled by air gages.

Wadkin (British woodworking machinery firm) is putting on the market for the first time a series of machines for profiling light alloys—in an attempt to go after British aircraft business. The machines operate on a routing principle, with servo controls to ease the work of operators. Wadkin has also developed a new type of universal miller.

One British-made special seven-head plano-grinder grinds several surfaces of lathe bed simultaneously, straight from rough castings.

Archdale and Ryder and Germany's Nassovia all are showing rotary-indexing transfer machines. The Ryder machine is an adaptation of the Rydermatic multi-spindle chucking automatic.

British-Built U S Machines

• **UNITED STATES:** American machines built in England are attracting much attention at Olympia. One is the Fellows-England high-speed gear shaper, Type 7125A, a prototype machine. Another is the first Lodge & Shipley 16-in. Powerturn lathe to be made by CVA. Catmur Machine Tool Corp Ltd is showing the first British-made Moore jig grinder. One of the first Brown & Sharpe automatic screw machines to be manufactured in England, by Mollart, is being shown. B & S will soon set up its own plant at Plymouth. At Britain's CVA exhibit is the first Kearney & Trecker knee-type miller that firm has produced. It has two elevating screws for the table. British Ex-Cell-O is showing an all-British-made transfer machine.

Also on show: Cincinatti Hypowermatics built at Birmingham, England; Micromatic honing machines built by Jones & Shipman (British); Crane Packing Co's Lapmasters made by Coventry Gage & Tool; Cone Machine Tool Co's Conomatics made by Britain's Churchill-Redman. (Cone is now completing a plant of its own at Birmingham); American Broach's machines made by Coventry Gage & Tool; and LaPointe broaching machines built by LaPointe Machine Tool Co's British subsidiary.

• **SWISS:** George Fischer has added full automatic loading and unloading to its copying lathes. One Rigid hydro-copy miller for larger types of steam turbine blades is unusual in that it is universal enough to cover a wide range of sizes. A new Fischer machine incorporates a new approach to the problem of producing gas-turbine blades—it turns the full aerofoil profile in one operation, instead of producing the convex and concave surfaces separately and then bending the edges. A copying technique is used.

• **FRENCH:** HEB, like Switzerland's Fischer, has added full automatic loading and unloading to its copying lathes for handling and turning bevel pinions.

• **GERMAN:** Alfing has an 8-station transfer machine at work on 4-cylinder and 6-cylinder heads—with automatic inspection. Schuler is featuring a 9-station transfer press with tool stations at 10-in. intervals. Press is equipped with pneumatic draw cushions, and stock is fed into press transversely from a reel. Bohner & Kohle has a flow-turning lathe with a center distance of nearly 7 ft, a swing of 60 in. over the upper slide, and 86 in. over the lower bed. It's powered by a 17 horsepower motor.

• **CZECH:** this Russian satellite sprung a surprise by showing three electric spark erosion machines—a "micro-perforator" for making small holes, a die sinker, and a saw for small section work. The Czechs say they have developed 14 different types of spark erosion machines—although only three are at Olympia. Several British and Swiss spark erosion machines are being shown at Olympia, too. The Czechs are also showing a Zbrojovka plano-miller with four heads, a 50 x 140-in. worktable, and a 23-ft-long bed.

News of Metalworking . . .

Metalworking's New Frontiers: the

Pressure molding of iron and steel in complex shapes, moving of metal to form a part, bonding by magnetizing metal molecules, continuous casting of steel slabs . . . they're just a few of the things to come in Metalworking's not-so-far-off future, according to Ford's Del S Harder—the "Father of Automation"

DEARBORN, MICH — You don't have to peer too hard into Metalworking's crystal ball to see some pretty revolutionary new concepts and techniques coming up in the near future. In fact, some of them, like adding boron to steel so it'll keep better in storage, are already here. Others are still a gleam in engineers' eyes.

That's not just looking through rose-colored loupe. It's a series of predictions made by the man who created the concept of automation, Ford Motor Co's executive vice-president, Del S Harder.

"It is difficult to set specific dates for the accomplishment of some of our possibilities," Mr Harder told Ford's Engineering Forum late last month, "but the achievement of some is more certain than predicting that the Tigers will beat the Yankees in the ball game you see tonight. Our ideas are not limited to Ford Motor Co . . . they have applications in other industries. Their effect will bring about a better standard of living for all of us."

Materials of the Future

What are some of these new concepts and techniques? As Mr Harder put it "manufacturing materials are as good a place to start as any. When you think of basic manufacturing materials in our business, you immediately think of steel."

Great strides have been made in recent years in the processing of native ore, Mr Harder said, but they have been too long coming because of the steelmaking industry's reluctance to change its techniques and processes. As it stands today, ingots are cast, then reheated and broken down into slabs or blooms, which are then used to make various types of steel. Experiments are going on right now to develop ways to take molten steel directly from the refining furnace and cast it continuously through a water-cooled copper mold into semi-finished slabs.

This, Mr Harder said, will eliminate costly and time-consuming stages of ingot casting, soaking pits and blooming mills, and he added, "If we keep going forward in this progressive manner—which we must —I can visualize steel mills of the future located right next door to the iron mines, with the conversion of ore to steel becoming one continuous process."

Boron Aids Steel Storage

Also on the subject of new and future metalworking materials, Mr Harder pointed out that the addition of boron to steel for protection in storage has been a great forward step that affects many manufacturing industries. And plentiful, inexpensive boron also greatly improves the quality of deep-drawn sheet metal.

By eliminating dissolved nitrogen's harmful effects, boron allows finished steel to be stored almost indefinitely without formation of stretcher strains. This factor alone greatly simplifies production programming, Mr Harder said.

Another material you can look for in the future—one that is particularly applicable to the auto industry, but that would also have its uses in the appliance and many other industries, is photo-sensitive pigment paint (*AM* July 2/56 Spot News p69) that would allow all automobiles to be shipped to dealers in a neutral white color. The dealer would give the customer his choice of any color (to match his wife's dress, if he likes) then play a controlled electromagnetic radiation gun over the paint to make it the desired color.

Not only that, this paint would be virtually self-cleaning, could expel dust and dirt from its surface when passed through a radiation field—either electrostatic or supersonic—doing a cleaning job "better than any wash rack you've ever seen," according to Mr Harder. And if you get tired of a color, you can run your car through a neutralizing energy field back to the original white, and start all over again with a new color—this time to match your wife's newest dress, not that old thing she bought last month.

In the interim, autos will be painted by the electrostatic method, in which a cloud of paint particles is attracted to any part of an auto body by a static electrical field—improving uniformity of paint application, and cutting down on paint overspray.

Still on the subject of future metalworking materials, Mr Harder said you can look forward to the alloying of aluminum, titanium and magnesium with rare metals like columbium in such a way as to vastly improve their engineering properties.

Extensive research has already gone into the possible uses of aluminum in automotive production, Mr Harder said—such as the aluminum-finned radiators that are being field tested today. And in the "very near future" the industry hopes to have aluminum auto radiators that would effect substantial savings in weight and in consumption of certain critical-supply materials.

"The never-ending search for synthetic material to replace metal in some applications will definitely continue on a stepped-up basis," according to Mr Harder. Such material, he said, might possibly be color-impregnated and formed to eliminate many of today's stamping and machining operations.

New Automated Process

And what about the future of automation? Here's what the man who started it all has to say about it:

- In a "relatively short time" Ford expects many of its machine tools controlled by magnetic tape, already has some in operation at its Chicago Aircraft Engine Division.
- Step by step with the development of automation will come many improvements in processing techniques. A few: production of a large number of parts like aluminum cylinder blocks from basic materials—almost eliminating final machining;

Load Will Come Off the Human Back

hot metal pressure-molding (similar to high-pressure die casting) for casting of complex parts to finished shapes and sizes even in such metals as iron and steel; plating of elaborate alloys on cheap base metals.

And there's cold extrusion, a relatively new process in which metal is moved, instead of removed by machining. This achieves (1) need for much less material, (2) such close dimensional tolerances that subsequent machining is greatly reduced, (3) an increase in strength and hardness of a given part to such a degree that heat treating is almost eliminated.

When it becomes necessary to bond dissimilar materials, Mr Harder pointed out there is already a method that magnetically bonds the materials' molecules for super-strong adhesion. Want to un-bond them? Just reverse the magnetic field.

In the area of materials handling, stamping operations have already arrived at a point where their speed is limited only by what can be handled at the end of the line. This is true of automotive engine lines, too.

Mr Harder visualizes electronically controlled handling of incomi materials this way. After arrival at the plant, materials are automatically classified and stored in special bins and hoppers. Daily requirements are then electronically selected, and the needed items are dropped onto moving conveyor belts or trucks to be carried to the point of use.

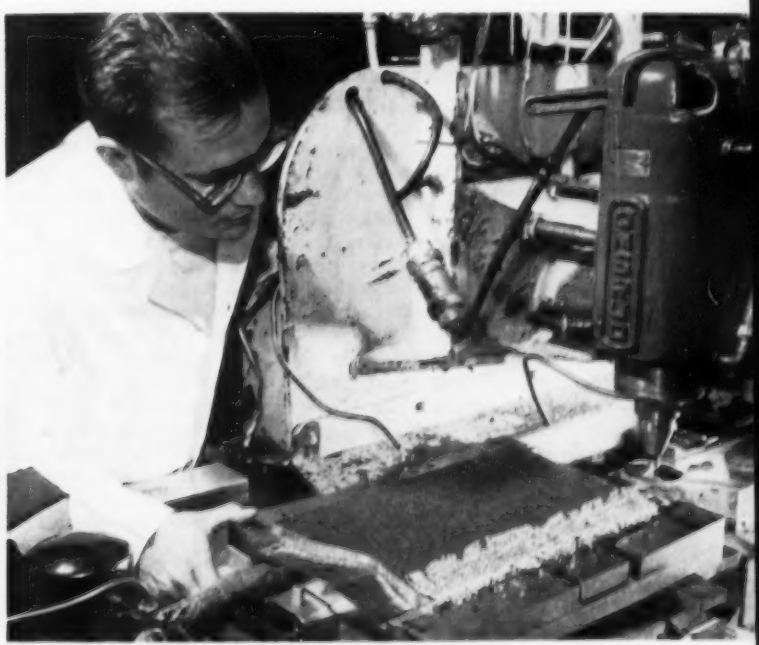
And industry today is on the verge of a really new method of shipping coal—moving it hydraulically through pipe lines like water through a hose. This could be applied to many other materials.

What about the plant of the future? They won't be too different from those of today, Mr Harder thinks. But building management and maintenance problems will be a lot different. For one thing, new corrosion-resistant materials will cut down maintenance, and sound-absorbing material will cut plant noise considerably.

It's possible future plants will be entirely heated by solar energy, Mr Harder predicts. Plant protection may be performed by televised plant-wise protection from a control point, with automatic warning systems. TV control of scrap loading is an actuality at Ford's Metal Stamping Division.

Built-in Quick Freeze Holds Honeycomb

Refrigeration on tap . . . A refrigeration unit coupled to coils in a milling fixture at Northrop Aircraft, Inc, Hawthorne, Calif, solves the problem of cutting metal honeycomb. The material is simply laid on fixture plate, filled with water, and rigidized by freezing in a few minutes. Then it can be cut to any desired shape by the circular tool in rear—really like a meat slicer. Bevels, slots and concave or convex shapes can be cut



Fixture tilts, too . . . The quick-freezing fixture also has another unusual feature. The table element rests on a central ball joint so it can be tilted to various stops and clamped at any desired angle for part of the cutting. Thus various parts of the surface may be cut to any required shapes. Here again the slicing-type cutter may be seen. A variety of cutter shapes has been developed

Ford "Building Blocks" Get Mixed

NEW YORK—Reactions of machine-tool executives to the Ford proposal for "building-block" machines (p 113 of this issue) are mixed, according to a limited survey by *AM* editors. Some are in favor of the idea, others believe it impossible to attain.

It should be pointed out initially that "building-block" construction is not an entirely new concept. It has been common for years for a machine-tool builder to undertake such standardization of his own products to promote interchangeability and cut costs. But there has been no concerted industry-wide effort of any importance. Drilling, grinding, milling, boring and tapping heads are available as units, and some companies also stock bases, tailstocks, headstocks or the like which may be grouped in various ways. Some recent designs permit mounting at any angle. Austin, in England, has for several years made its own standardized components for transfer machines (*AM*—Mar 14 '55) and similar programs have been adopted by American builders individually.

So to the survey opinions:

"It's Been Tried Before"

● "At the present time when any one of the automobile people buy a drill head, they have different types of flanges and different sizes of holes that hold the drill head to the flange. We tried for years to adopt a standard so that they could take the drill head off one machine and put it on any other machine they had in their plant.

"We tried to adopt guide bars so that they would be standard and could be used on any of the fixtures. We also tried to arrive at some standard spindle dimension so that they could fit different chucks, drill heads and other miscellaneous parts direct to the spindle.

"We have also tried to standardize sizes of tee-slots, distances between tee-slots, distances between top of the table and spindle nose, and many other things.

"There were always one or two companies in the crowd that wouldn't go along and they would argue so loud and long that we just would get disgusted and quit.

"As long as this condition exists, it will be extremely difficult to make any of these changes unless the automobile people themselves do the job."

"I Firmly Believe in It"

● "I firmly believe in the building-block approach—in fact, our new machine has been designed on the principle. On some machine tools, such as the larger grinders, the unitized approach will be more difficult, but I firmly believe it is the coming thing, particularly in fully automatic production lines."

"It Is Essential"

● "It seems to me that it is essential that this be done in order to make it possible for the automotive companies to change their designs and yet eliminate some of the tremendous expense in retooling."

"Aladdin's Magic Lamp"

● "You can search catalogs, factories, and history books, and the only place you will find a tool that will take care of all of Mr Public's wants is in the story of Aladdin's Magic Lamp. According to fable, one rub and you can have anything you want—and right now. No cost, no waiting.

"The kind of machine tool we want for tomorrow is a modern version of Aladdin's lamp—even the pushbutton must go. As a matter of fact, our ability to survive as a free nation may depend on it . . . we may *need* a magic lamp. In short, we need machine tools with more productivity and more flexibility. Most people believe the answer is more and better automation. . . . It is my opinion that machine-tool builders must provide more flexibility before automation will be universally accepted.

"The philosophy of modular construction offers one of the best ways of getting flexibility into automation at reasonable cost. . . ."

A "Bright Idea"

● "There is no question but that the subject of 'unitized' machine tools is a bright one and that transfer machines will more and more tend to be built in this manner. Whether the possibility of standardized 'units' is as bright is questionable.

"No doubt in some areas it may be possible to standardize the critical dimensions of units as manufactured by different builders, but in the grinding machine and lathe field at least, it would appear that standardization will come in the transferring equipment much sooner than in the machines themselves, since they do not lend themselves to ready inclusion in a building block type of transfer machine."

Remember Brand Names

● "'Unitization' is a good idea and we will see more of it in future designs. I am, however, skeptical that we will reach the stage where, symbolically, you can strip down a Ford and rebuild it with a Chevrolet engine and a Plymouth transmission. 'Unitization' is a phase of standardization and engineers are each year becoming more appreciative of the advantages of standardization. The simplest highly-specialized machine tool to complete a cut on millions of a specific part needs but one spindle speed, one feed rate, one length of feed stroke, and one fixed cycle. If production is not in the millions and next month or next year you must produce a different piece, then you are handicapped by the single-speed machine and begin to wish your machine tool had several available speeds and had a few universal features. This is an old story to the producers of medium-size lots of parts who always purchase machine tools with an eye on future convertability.

"I would judge that the automotive engineers have gone a little too far in the specialization of machine tools and that 'unitization' represents a swing back in the direction of universal design."

How About Duplicates?

● "Recognizing that there are many unit-type transfer machines in operation today, one might well ask why users do not buy duplicates of the units that have already been designed and in use and insert these units into their present machine. This should result in some form of standardization in itself. The fact remains, however, that machines need to be made to produce the part. The design of the part is seldom adapted to the machine that is avail-

Reaction from Tool Builders

able; particularly if entirely new units are being built. Obviously, as parts change, operations change and machines change; particularly if a combination of operations is required at any one stage. It, therefore, seems to me that it would be rather unrealistic to expect a designer of machines that are being used today to be able to foresee all the flexibility required in the years to come and so effect complete future standardization.

"I do not wish to sound completely negative, I believe there are opportunities which will be beneficial to both the builder and the user and, no doubt, the results would be most effective if the user exerted some leadership."

Britain Couldn't Do It

• "You are also no doubt familiar with the 'Productivity Team Report,' of a team representing the British Machine Tool Industry who visited the United States in 1951, which was published in January, 1953. This team report carried unitization to the limit, having some individual firms specializing on standardized spindles and housings, some on standardized driving units, some on standardized feed units, etc, and other firms which were purely assembly firms, buying these units from the individual firms and making machine tools of them. However, this was too much for even a socialized British Machine Tool Industry to swallow. So much for that!

"In discussing the 'building-block' idea, I believe a sharp distinction should be drawn between high production machines of the transfer type—which, of course, are an aggregation of simple machine tools tied together with a transfer mechanism—and what might be called standard machine tools, each of which is a unit in itself.

Unitization OK for Transfer Machines

"As far as the 'transfer' type of machine is concerned, I thing there is no question but what 'unitization' is feasible; but isn't Ford talking more about standardization of dimensions than anything else, and really isn't the basic idea behind this unitization the thought that General Motors, Ford, and other mass production companies, will be able to buy units on a competitive market and put them together themselves?

"I can imagine Cross, or some such company, being willing to design a complex transfer machine for Ford, the units of which can be shifted about, changed, subtracted from or added to with Cross units, but I can't imagine Cross, NATCO and other builders of transfer machines getting together and designing competitive units which the high production manufacturers can buy from any one of them and put together as a new machine.

"I also believe very definitely that standardization of the kind suggested would have a very adverse effect against the introduction of new achievements.

Most Tools Standard

"It must be remembered that while 'transfer' machines are not only very spectacular in operation, but also very necessary for mass production of certain types, the large majority of machine tools built are what are known as 'standard' machines. Standardization of such things as spindle noses, T-slot dimensions, turret face dimensions, etc, has been going on for a long time but still has a very long way to go. These are all tool mounting dimensions and I don't think there is any question but what sooner or later they will all be standardized.

Already In Use

"As far as the 'building block' idea as applied to standard machine tools is concerned, most machine tool builders are now, I believe, using the 'unit' type of construction, but units of their own design. These units are usually interchangeable between machines of different capacities and even of different designs, but I cannot imagine one turret-lathe builder buying from another a feed gear box, for example, nor can I imagine the other concern being willing to sell it to him. To sum it up, my belief is that while at any given period individuality may be and probably is inefficient, over the long run it is the one way in which we progress."

More Money For Military Hard Goods?

WASHINGTON—There are more signs of an upswing in military hardware spending:

• Defense Secretary Wilson told the Symington Committee the Defense Dept will seek more funds for fiscal 1958 than it did for fiscal 1957. In earlier testimony, the three service chiefs of Staff said they will need a total of about $14 billion more than the $34.6 billion appropriated for this year.

• The Pentagon has hiked its spending estimates once more for fiscal 1956 and fiscal 1957. Latest figures show that last year's expenditures will come to $35.6 billion—a $1.6-billion hike over the initial Pentagon estimate. This years spending total is now expected to hit $36.1 billion—$400 million more than the original figure. Another boost in the estimate before year's end is not unlikely.

• Congress showed its temper on defense spending when it tacked on $900 million to the administration's military appropriation request for fiscal 1957. Of this sum, $800 million is earmarked for production of additional B-52 heavy bombers, $100 million for accelerated Air Force research and development work.

Odds are next year's appropriation request will be scaled down substantially from the figures toted up by the services. Wilson says "This country doesn't need a $48.6-billion program; nothing has changed that much in the world." He warns that such an increase "would require new controls and a partial mobilization like Korea's."

Wilson has also tried to put the skids on the budget increase voted by Congress. He refuses to say whether he will allow the Air Force to spend the extra funds this year. He says the additional money is not needed since the Pentagon already has a carryover of $10 billion previously appropriated but still obligated, and that the Defense Dept will commit about $2.7 billion more this year than was appropriated.

The issue of a step-up in B-52 production has become a heated one. Top Air Force generals have called for production of at least 300 more aircraft than are now scheduled.

(Continued on next page)

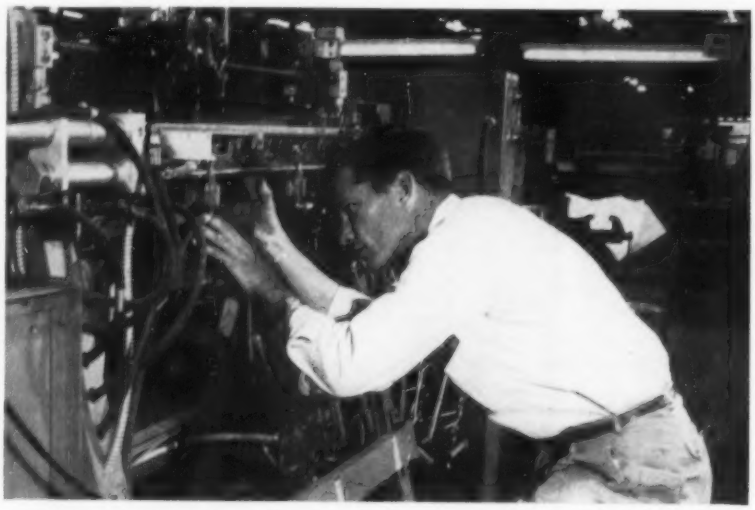
MILITARY HARD GOODS (cont'd)

Much of the problem boils down to this: is there enough idle capacity to be put to use in a hurry?

Senate Democrats say there is. Boeing President William M Allen and the Air Force's Deputy Chief of Staff for Materiel, Lieut. General Irvine both have indicated to Congressional committees that B-52 output could be doubled under existing capacity. Wilson says this is only "partly correct." He says there is enough physical plant capacity but that a substantial amount of additional tooling would be needed quickly. In 18 months productive capacity will be for 20 planes monthly. Wilson explains that to boost planned capacity to that figure from only 17 planes, $18 million worth of machine tools had to be ordered.

Wilson has been the key witness in the closing round of the Senate's three-month long investigation into the adequacy of U S airpower. From the Air Force's top echelon of generals, a Senate Armed Services Subcommittee headed by Missouri's Stuart Symington has drawn detailed testimony that Russia is gaining over the U S in aircraft production and research and that one of the reasons is a skimpy Air Force budget. In his testimony, Wilson:

- Challenged Air Force Chief of Staff Nathan F Twining's statement that the Russians lead the U S in production of modern jet aircraft and are making technological advances faster than this country. He said LeMay talks "generalities."
- Disagreed with General E LeMay, Strategic Air Commander, who told the committee Russia's long-range striking power will be superior to ours by 1958-60 under current production schedules. Wilson also said the B-52 heavy bomber is "greatly superior" to Russia's Bison intercontinental bomber in speed and combat radius and flight ceiling. LeMay has been willing to say only the planes are "comparable."
- Disagreed with demands by Air Force generals that more money is needed for extra B-52 production and for accelerated research.
- Claimed that during 1953 and 1954 the Russians were emphasizing the buildup of a defense air force rather than an offensive air arm. Statement clashes with continual warnings from Air Force leaders that the Russians have been playing up a long-range striking force.



Prototype honeycomb-making machine . . .
is still in the proofing stage at Convair-Fort Worth, where it fabricates 1-in. core automatically. Biggest bug still to be ironed out: finding correct pressure, time, and current to weld 0.0015 stainless ribbon

Convair Develops Sandwich Panels For Use in B-58 Primary Structures

FORT WORTH, TEXAS—"Greatest development in airplane construction since the all-metal airplane," according to its creator, Convair-Fort Worth, is in the final proofing stages here. It's a new combination of machine, materials, and methods that makes it possible to use bonded panels and honeycomb sandwich panels in the primary structure of the B-58 supersonic bomber. While bonded and sandwich panels have been in use on plane wings for some time, this marks the first time such components have become part of the primary structure of an aircraft.

Convair first used the bonding process on B-36 bombers, later on the Sea Dart, Tradewind, F-102 and TF-102. New refinements of the adhesive will permit their maximum use on the new B-58 bombers.

Develop Automatic Machine

The epoxy-based adhesive, 422-J, developed by Shell Development Co, makes it possible for Convair to bond metal to glass fiber in sandwich panels composed of thin metal skins bonded either side of a special core, lighter than metal.

Continuing the research work, Convair Fort Worth set out to develop an automatic machine that can fabricate 1-in. 17-7 PH, 18-8 stainless core. Biggest problem now is in achieving the right pressure, time, and current for welding the 0.0015-in. ribbon.

The machine works this way: operator feeds in steel from a spool. Machine then bends the metal strip into a row of tiny ridges to make one-half of one row of cells for the finished honeycomb. Then a second row is formed, with identical ridges, and welded to the first—and so on until a full sheet of core is complete.

A big brazing furnace, newest addition to the program, is being installed so that honeycomb panels with both the outer skins and core of stainless steel can be manufactured. Patent rights are reserved.

What are the advantages of honeycomb paneling in the aircraft industry? These are the most important, according to Convair:

- Bolts and rivets are eliminated to produce an aerodynamically smooth surface.
- Bonding eliminates stress concentration points created by conventional fasteners—distributing stresses uniformly.
- Weight is cut down considerably through elimination of fasteners, and by use of thinner skins.

J Robert Jones (left), general sales manager of Kearney & Trecker Corp, has been elected vice president, sales. **H W Kippers** (center), has been named sales manager of the Standard Machinery Division, and **Carl F Enroth**, sales manager of the Special Machinery Division (*AM*—July 2 '56, p143)

Names in the News . . .

Carl W Petersen, vice president and works manager of Dodge Manufacturing Corp, Mishawaka, Ind, has been elected executive vice president. **Earl Wedlake**, production manager and director of purchases, has been appointed vice president, production and purchasing. **Lloyd F Lamm**, vice president and general manager of Chicago Thrift-Etching Corp, a subsidiary, has been named president of that company.

Edward N Clark, superintendent of cutting tool manufacturing at Pratt & Whitney Co, West Hartford, Conn, has been promoted to assistant to the factory manager of the Cutting Tool and Gage Divisions. **Ralph Winspear**, assistant superintendent of the Gage Division, has been made superintendent of the Cutting Tool Division.

William F Ryan, vice president and senior consulting engineer of Stone & Webster Engineering Corp, Boston, has been nominated to serve as 1956-57 president of the American Society of Mechanical Engineers. He will be installed at the annual meeting in November.

George J Schwartz has been appointed vice president and general manager of the Doelcam Division of Minneapolis-Honeywell Regulator Co. He was formerly divisional vice president.

William T Welch has been elected chairman of the board of Ajax Flexible Coupling Co, Westfield, NY. Also elected: **Wayne Belden**, president; **Harley E Northrop**, executive vice president; and **Charles W Belden**, vice president.

Cresswell Ramsey has been elected vice president, production, of the Wellman Engineering Co, Cleveland. Prior to the appointment he was general production manager.

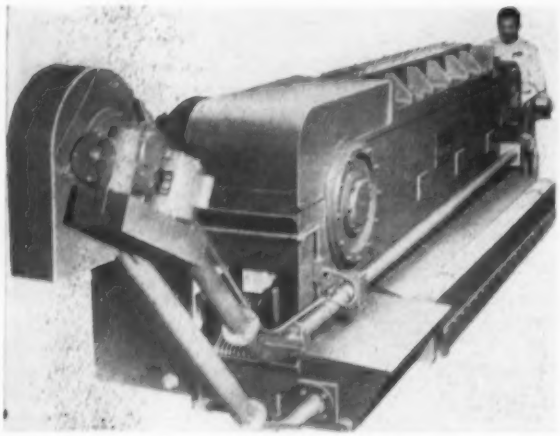
Obituary

Carl J Snyder, 59, vice president and director of Chrysler Corp, and operating manager in charge of all manufacturing operations, was killed June 30 in the United Air Lines plane crash in Arizona. Mr Snyder was a foreman at Maxwell Co, predecessor of Chrysler Corp, which he joined when the companies merged. From 1928 to 1940 he was master mechanic of the Dodge Forge and Dodge Truck Divisions; in 1948 he was made general manager of the company's Lynch Road plant in Detroit, was named operating manager of the corporation in 1951, and vice president the following year.

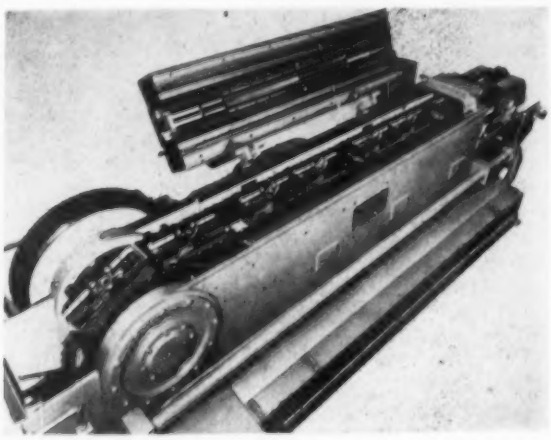
Charles H Crawford (left), plant manager of Colonial Broach & Machine Co, and **W W Wood**, general manager of Colonial Bushings, Inc, an affiliate, have been elected vice presidents of the company

Carl J Snyder

New Shop Equipment,



HORIZONTAL BROACH weighs 35,000 lb, with tunnel and broaches alone weighing 3750 lb. Unloading is done automatically by gravity



BROACH-CARRYING TUNNEL is raised to illustrate heavy-duty twin-chain conveyor and hammer-lock fixtures

Horizontal Continuous Broach Features Rigid, Heavy Construction

Heavy-duty horizontal continuous broaching machine has automatic fixture locking, operating, and unloading. Loading can also be done automatically when required.

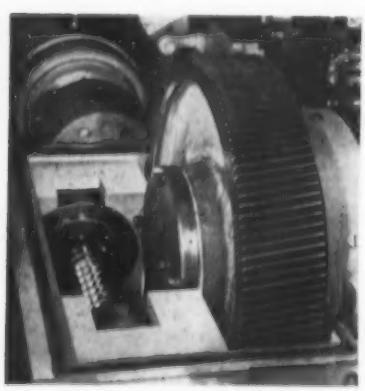
Long broach life and fine finishes are made possible by the heavy, rigid construction of the machine, which has a welded frame and heavy steel plates. An oversize bull gear provides the pulling power, extra weight, and smooth operation needed for fine finishes.

Easy, safe loading and unloading of work is provided by the rather large 21½-in. radius from chain axis to outer machine frame. Safety interlock device prevents operation until parts are positioned positively in work fixtures.

Cutting speeds up to 40 fpm can be obtained from the twin-chain electro-mechanical drive. Other speeds are available through change gears. Fixtures, which can be varied in number, are of the hammer-lock type, automatically located, locked, opened, and emptied.

Machine is self-contained, including the filtered coolant tank, pumps, and automatic chip-disposal unit of endless-conveyor type. Model illustrated has 90-in. stroke with 15-ton capacity, and is approximately 60 in. high, 70 in. wide, and 207 in. long. Other 15-ton models are being built with 66-in. stroke and 120-in. stroke, while lower and higher tonnage capacities are available.

Detroit Broach Co, Rochester, Mich



MASSIVE BULL GEAR, directly connected to main-drive drum, weighs more than 950 lb

McKenzie Machine Separates Chips from Screw-Machine Parts

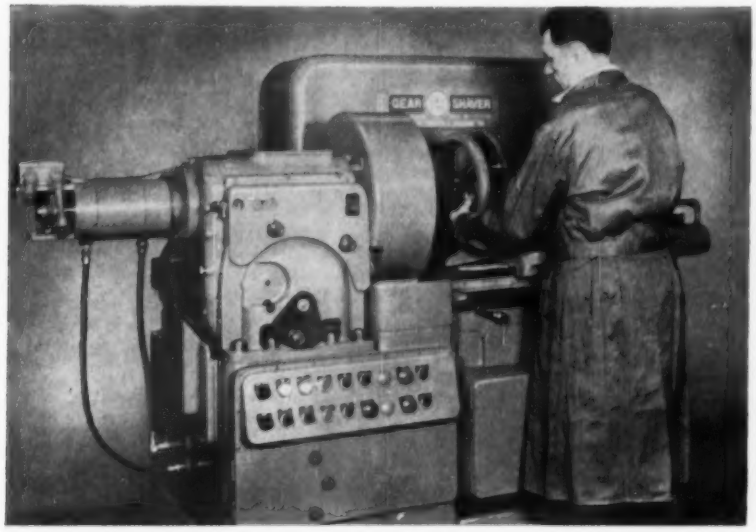
Floor-model chip separator, Model E, is designed to separate screw-machine parts from waste chips. Rigid construction and specially designed automatic feeder—vibrator unit reduce vibration and noise to a minimum.

Centrifugal blower unit has 40 air settings to provide clean separation

and accurate control for any size screw-machine parts in diameters from 1/16 to ¾ in. and lengths from ¼ to 3½ in. Parts and chips are fed to the separation area at a maximum rate of ½ cu ft per min; parts are then delivered to tote pans at machine side and salvage chips are discharged at front.

McKenzie Engineering Co, Newtown, Conn

Materials and Parts . . .



Semi-Automatic Loader Speeds Work On Internal Gear Shaver

Improved Red Ring Model GCR internal shaver is equipped to handle internal spur and helical gears from 3- to 12-in. PD having teeth up to 4 diametral pitch and tooth face-widths up to 2½ in.

Semi-automatic loader incorporated in design is said to speed loading and unloading operations. Operator merely hangs gear to be shaved on the shaving cutter, presses a cycle-control button, and removes gear from workhead after shaving. When gear is hung on cutter, an approximate locator on the cutter head positions gear in correct radial location. After cycle start, cutter head advances and part pilots into the holding fixture in the workhead. Part is then automatically clamped and the shaving operation initiated. After operation, cutter head retracts and part is automatically released from workholder, ejected, and removed by operator.

Workhead on machine illustrated permits taper-shaving operations to be performed on internal gears. Either conventional shaving operations with cutter reciprocation or plunge-cut shaving without cutter reciprocation can be done.

National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich

Deep-Throat Micrometer Measures Sheets and Plates

Chrome-clad deep-throat micrometer is designed for gaging the thickness of metal sheets and plates, permits measurements up to 3¼ in. from edge of work.

Frame is heavy-duty and ribbed, with a black, non-slip finish. Tool is available with a range up to 1 in. in graduations of 0.001 in. with either a plain or ratchet cap.

Lufkin Rule Co, Saginaw, Mich

...including

MACHINE TOOLS AND ATTACHMENTS

Rotary Grinders 174
Drill Centering Attachment 174
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TOOLS AND ACCESSORIES

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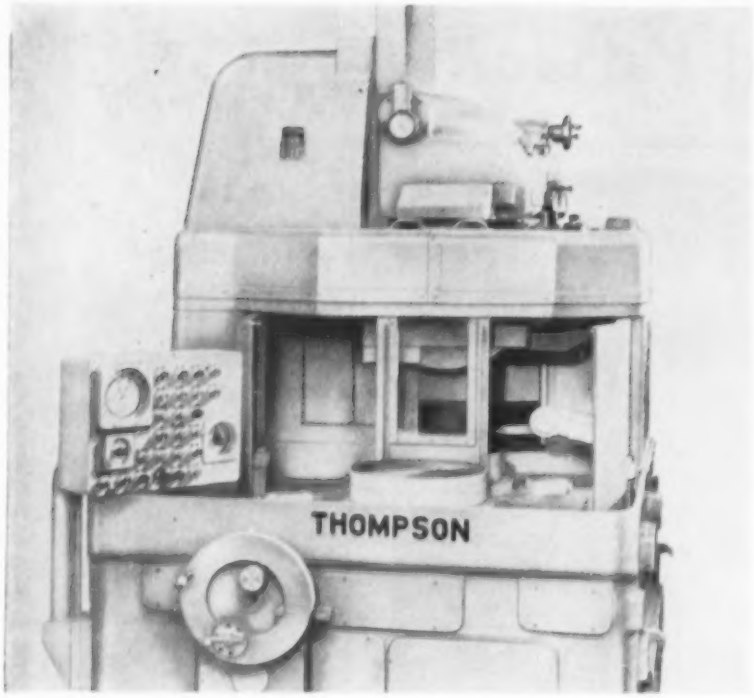


Thompson Twin Rotary Machines Have Automatic Grinding Cycle

Type TR twin rotary production grinders, available in six models ranging in table size from 6 to 24 in., are provided with automatic machine cycle. Operator starts cycle by pressing button. Wheelhead moves downward, contacting work and removing a predetermined amount of stock. Spark-out cycle then occurs, wheelhead returns to up position, operator unloads ground parts, and grind cycle starts again automatically in rear position.

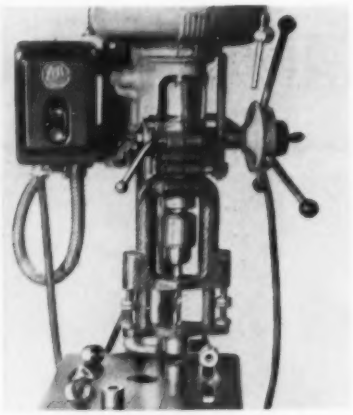
Reduced cycle time is possible with the twin-head units, because operator can load one magnetic chuck at front position while another part is being ground automatically in rear position.

Features include horizontal-wheelhead grinding with 14- or 20-in.-dia wheel to controlled size, with automatic compensation of the feedscrew; in-position wheel truing to dress wheel automatically, pre-set and to machine cycle; maximum rigidity, with worktable supported on large bearing surface; anti-friction elevating nut; variable-speed worktable drive; separate coolant system with extra-large tank; and optional automatic gaging equipment.

Machine illustrated has 12-in. table, 17-in. vertical capacity, and wheelhead speeds to 1200 rpm provided by 30-hp motor. Table speeds range from 8 to 80 rpm. Standard equipment includes wet-grinding attachment, two standard grinding wheels, automatic starters on all six motors, and one wheel mount.

Thompson Grinder Co, Springfield, Ohio

GEAR CLUSTER of SAE 5135 is finish-ground with stock removal of 0.008 to 0.010 in. to ± 0.0015 in. Finish is said to be 25 mu-in.



Drillpress Attachment Simplifies Finding Work Centers

Called the Center Master, drillpress attachment reportedly simplifies finding the center of round, square, or hexagon stock in drilling, counterboring, chamfering, or reaming operations. Device uses a bushing, together with a top collar which goes over the quill, to fit any type or size drillpress.

Chuck is located in the center of the frame. Drill, reamer, or counterbore comes down through frame and is guided through a bell bushing, fastened to the bottom plate by a setscrew, which locates work. No holding device is necessary.

For drilling cross holes in work, bell bushing can be removed and a V-block placed in the bottom plate. V-block holds securely and can be designed to locate a hole in any part and at any angle desired.

Center Master Corp, 3757 S Kinnickinnic Ave, Milwaukee 7, Wis

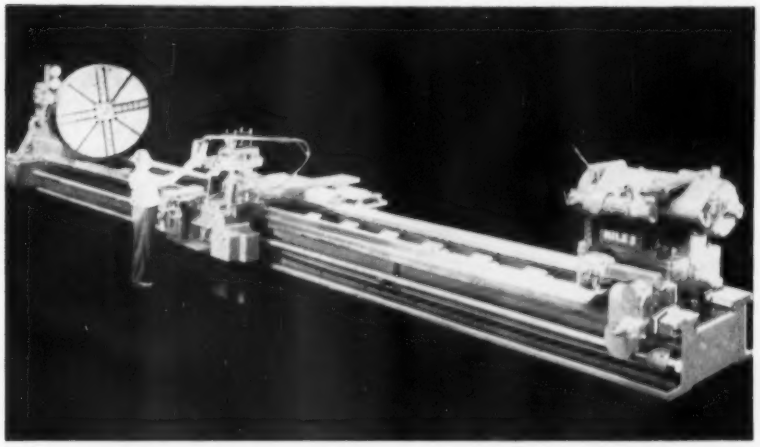
Deublin Union Feeds Coolant Under High Pressure

Coolant union for gun-drilling and gun-boring operations introduces coolant under high pressure for effective cooling of tool cutting edge. Straight-through design eliminates coolant turbulence and pressure drop ell-type unions are subject to.

Device develops a maximum speed of 10,000 rpm, maximum pressure of 1500 psi. Starting and running torque are held to a constant minimum through balanced sealing and two single-row, sealed ball bearings.

Union features a leakproof seal: hardened, ground, and micro-lapped steel rotor runs against a micro-lapped carbon seal. Sealing faces are held together by a constant minimum pressure; line pressures cannot increase the load on the faces.

Deublin Co, Glenview, Ill



Niles Heavy-Duty Engine Lathe Has Headstock Speed-Load Indicators

Model 72-A engine lathe is a heavy-duty machine which incorporates such features as speed and load indicators on the faceplate drive, load indicator on the tailstock quill, enclosed leadscrew speed and thread selector dial, hydraulic booster on the faceplate speed changer, lubrication oil-pressure protection, and optional electronic feed control.

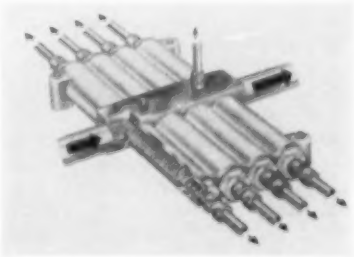
Speed and load indicators on headstock enable operator to keep a close check on machine performance and assist him in loading unit to capacity without danger of applying excessive overloads. Load indicator on tailstock quill obviates guesswork when preloading the quill spring to suit workpiece, saving time in setup and preventing damage to centers.

Operator controls machine at the carriage station through a pushbutton panel. Electronic feedbox, mounted at tailstock end, drives the splined leadscrew. Rate of feed—longitudinal, cross, or angular—in ipr of the faceplate, remains proportionate to any change in faceplate speed. Feed drive motor or gear ratio in the electronic feedbox changes automatically to coincide with changes in headstock gear ratios. When lathe has electronic feeds and threading, mechanical feeds are also available; one lever selects type of feed. 64 feeds are available on the unit.

Main drive is by a 100-hp, adjustable-speed, 400-to-1600-rpm dc motor, but variable-voltage drive can be substituted to meet custom specifications. Faceplate, with adjustable-speed dc drive, has three mechanical speed ranges: through faceplate drive, 1.35 to 5.4 and 5.48 to 21.9 rpm; through spindle drive, 25.2 to 101 rpm. Power traverse motions, independent of main feeds and spindle, are obtained from a separate 5-hp motor mounted on the carriage apron.

Swing over bed and carriage wings is 73½ in., and 56 in. over carriage bridge. Faceplate diameter is 72 in. Distance between centers is nominally 46 ft, but can be varied on special request. Over-all length is 13 ft plus distance between centers. A wide variety of extra and alternate equipment is available.

Baldwin-Lima-Hamilton Corp, Hamilton, Ohio



Clearing Lubrication System Meters Oil to Prevent Clogging

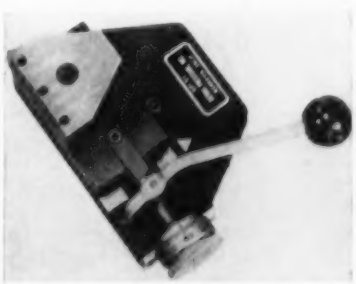
In the Clear-Flo press-lubrication system, metering devices control the flow of oil accurately and safely. Devices consist of inserts resembling large, exaggerated screw threads which are placed inside tubes; oil passes spirally through a metering block (illustrated) around the insert on its way to the lubrication point.

System reportedly provides metering without restriction. At no point in the circuit is the oil passage reduced to less than the area of a 5/32 in. tube. Metering is a result of "friction" of the oil against the inner wall of the tube, and the devices are calculated to place the right amount of oil at each individual gear and bearing in the press. No adjustment is ever necessary in the field.

System differs from more conventional systems, in that it has no moving parts other than the main pump. No constrictions on oil line are present, because there are no built-in metering devices where foreign matter can collect, and no piston mechanisms which can clog and fail. Any foreign material is flushed completely through the system and removed by a mechanical filter.

Flow of oil through a straight-side press can be described as follows: Oil is pumped from sump located in press bed or upright through the filter. It is then pumped to the top of the crown to several distributing blocks where it is metered and directed to various parts of the press.

Clearing Machine Corp, Div of U S Industries, Inc, 6499 W 65th St, Chicago 38, Ill



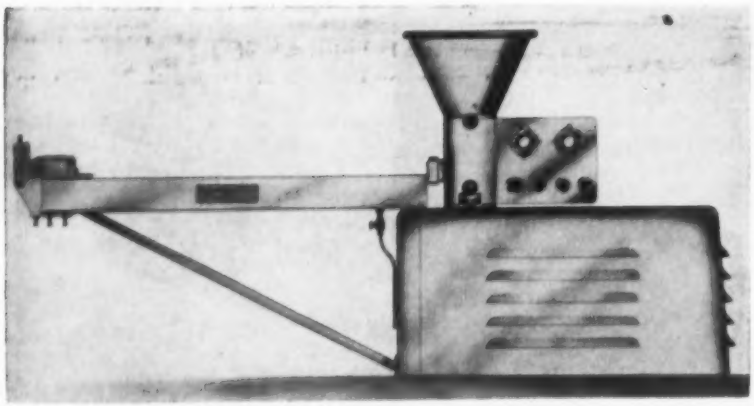
Sierra Threading Attachment Fits Engine Lathes

Model SP-51 single-point threading attachment can be installed on any engine lathe having a minimum of 1-15/32-in. distance from centerline to top of compound. Device can also be used on turret lathes when it is desirable to feed the tool in at an angle.

Micrometer adjustable stop assures repetition to 0.0005 in. in diameter. Handle permits fast pull-out from thread or work shoulder for close work in tight spots. Smooth, sensitive feed permits operator to "feel in" when machining "O" and snap-ring grooves, trepanning, and cutting internal reliefs.

Sierra Precision, Inc, 925 S Magnolia Ave, Monrovia, Calif

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Reed-Prentice Bench Extruder Offered in Vertical Version

Reed Autoflow 20V is a packaged unit, featuring built-in material dryer, take-off equipment, and water bath. Bench-model extruder is designed to extrude vertically.

Machine requires only a 1-hp motor to extrude 20 lb of thermoplastic material per hour. Its vertical revolving screw extends upward into the hopper, keeping the granular material always in motion and drawing it down into the screw barrel uniformly.

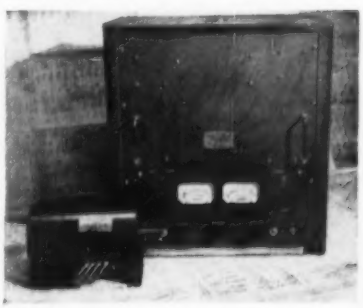
As flights on the screw draw the material down, it reaches a section of the barrel heated by electric bands, becomes plasticized, and is folded backwards as it meets reversed pitch flights. Build-up of pressure here forces the plasticized material out through the die, which is located at a point that coincides with the barrel section where screw flights change from downward flow to reverse pitch.

Heat normally wasted in a horizontal extruder is used here to preheat and dry material in the hopper. To further this action, a stream of air is directed downward through the hollow screw; air is heated and then flows up through small ports and through the material. Electrical heating bands on lower part of barrel also aid in drying material.

Reed-Prentice Corp, Worcester 4, Mass

Cold cleaner for spray washers, designated Klem Kleaner 258, is furnished as a compound for addition to water. Product, said to have high rust-proofing qualities, can be used to remove all types of oil and soil.

Klem Chemicals, Inc, 11401 Lanson Ave, Dearborn, Mich



Teller Automatic Control System Simplifies Automation Problems

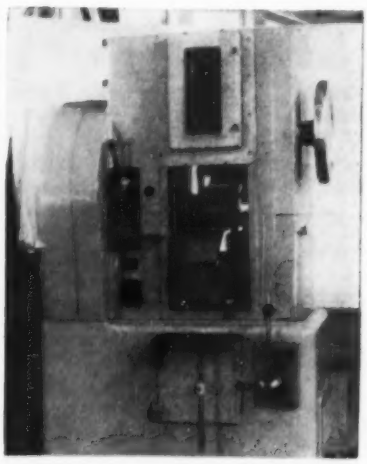
Main component in an automatic control system for the tape-programmed operation of machine tools is a special motor, developed by Industrial Controls Corp of Chattanooga, Tenn, which is said to provide a high degree of precision and rapid operation. Together with its special amplifier, motor reportedly permits elimination of much complex equipment, reducing the number of vacuum tubes from the 400 which some systems require to 20.

Motor is basically a step motor with special refinements. As the system operates, a tape or punched card is the control medium, with one mark or other characterization on the tape corresponding to one step motion of the motor, thus providing an electrical gear system. Individual steps can be made so fine and the motor operated at such a high speed that work output is very smooth. Motors can be built so that each step represents a very small angular displacement of the rotor. Standard sizes will cover outputs ranging from in.-oz of torque to thousands of in.-lb.

Illustration shows setup for welder positioning control in which step motor controls position of welding rod so that it follows work contour, regardless of variations in construction of part. Sensing device rides work, giving exact contour information to special amplifier (housed in cabinet); amplifier in turn directs step motor which positions welding rod.

Other characteristics of motor: high starting torque, magnetic locking when stopped, and fast acceleration and deceleration. Several motors can be coordinated on a single tape, so that three or more units can be tandemed for multiple operations.

Teller Co, Butler, Penna



Haller Powdered-Metal Presses Offered in Improved Models

Mechanical briquetting presses, available in capacities of from 8 to 40 tons, have been improved over older models to incorporate several additional features: one-shot, central lubrication; special volume-controlled filler-shoe mechanism; and redesigned core-rod bracket.

"Separated" filler shoe insures a measured amount of powder into the die in any desired quantity. Divided into two sections—a hopper and the shoe—the mechanism is cam-operated to deliver a predetermined quantity of powder to the shoe—the portion that moves over the die. Damper between this section and the hopper is actuated by a cam pre-set for the desired amount.

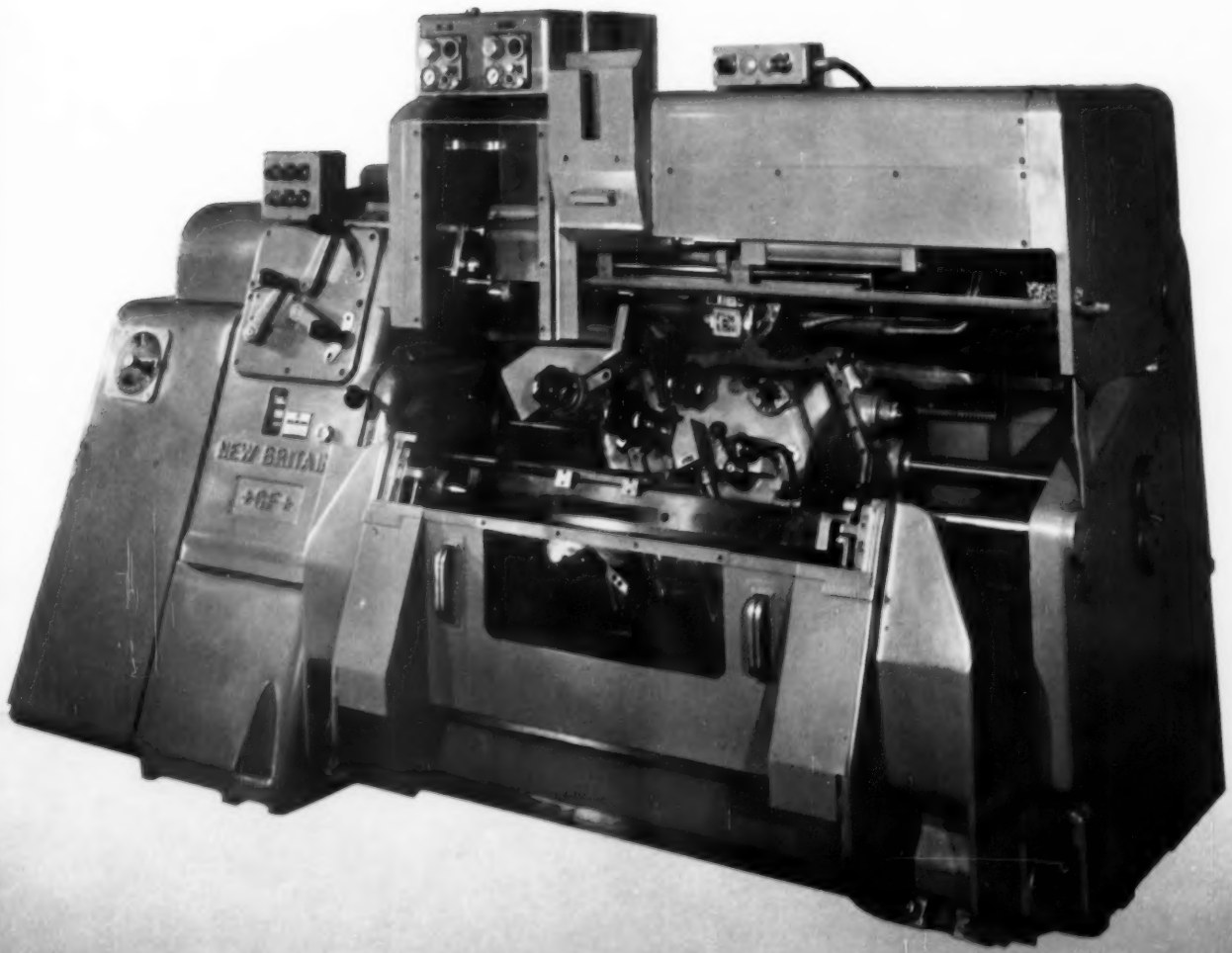
Core-rod bracket simplifies tool design by permitting the use of short core pins attached to a stationary core rod. Access is quick, through a door at the front of the press.

Haller, Inc, 68½ Ann Arbor Rd, Plymouth, Mich

old methods can't compete

If you do *any* turning you should investigate the New Britain **+GF+** line of copy turning lathes—whether your work calls for sustained production or short runs demanding quick setups. It turns tapers and complicated contours with the same setup used for simple O.D.'s. No need for expensive form tools. Let us demonstrate this completely different approach to turning in a color motion picture demonstration at your desk.

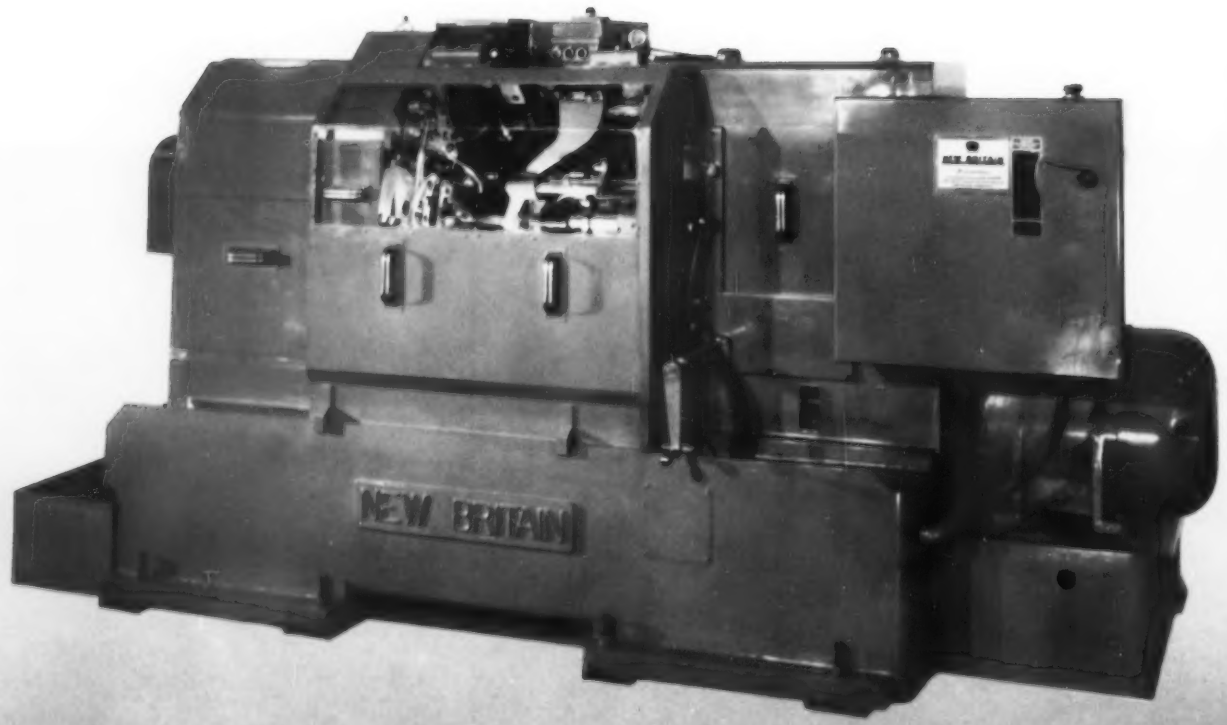
THE NEW BRITAIN MACHINE CO.
Model 11/70
New Britain +GF+
Copying Lathe
NB



a long new step forward in bar machine productivity

THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB

Here is a new New Britain bar machine with the ruggedness, power, speed and versatility to shed new light on your profit picture. Where you have bar work that now requires more than one machine, it may be practical to eliminate costly finishing operations by doing the whole job on a New Britain Model 62. Ask your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



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FREE Catalogs, Booklets, Charts, Calculators

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MACHINES AND ATTACHMENTS

1 EXTRUSION PRESSES—*Lake Erie Engineering Corp, Buffalo 17, NY.* 8-page bulletin 14.17 illustrates line for extrusion of ferrous and non-ferrous metals. Basic design features described—billet loader, die slide, inserted steel cylinder and shear construction.

2 SURFACE GRINDER — *Abrasive Machine Tool Co, East Providence, RI.* 8-page illustrated catalog covers No. 618 hand feed precision unit, 6 x 18 x 12 in. Features and operational advantages described.

3 BORING HEADS—*Briney Mfg Co, Pontiac, Mich.* 12-page catalog 6B illustrates and describes six standard precision size-positive boring heads and an adjusting principle for close tolerance boring allowing adjustments as fine as 1/10,000 in. without loosening or tightening any screws.

4 PRECISION HOLE BORER—*Canton Tool Manufacturing Co, Canton, Ohio.* 4-page booklet contains information on unit that employs a new principle to permit production center-drilling, drilling, and boring operations at eight times the speed of conventional jig boring methods. Design features illustrated; performance data and specifications included.

5 IRON HAND UNLOADING MACHINES—*Sahlin Engineering Co, Birmingham, Mich.* 16-page catalog illustrates and describes typical applications for automatic press unloading operations. Covers overhead unit, portable model, turnover and transfer machines, variety of gripping jaws.

6 BALL BEARING CENTERS—*Ready Tool Co, Bridgeport, Conn.* Illustrated folder 5-56 describes new Red-E grinding concept said to overcome chatter, wheel marks, out-of-roundness and secondary operations required for super finishing and lapping in cylindrical grinding.

7 AUTOMATIC GAGING — *Federal Products Corp, Providence 1, RI.* 26-page catalog 56 AM contains detailed, illustrated descriptions of electric, air-electric, electronic, and air-electronic control systems, and shows how these systems are applied to in-process, post-process, and combination gaging methods. Applications, characteristics, auxiliary equipment, mechanical components, and accessories described.

TOOLS AND ACCESSORIES

8 PROGRESSIVE DIES AND TOOLS —*B Jahn Manufacturing Co, New Britain, Conn.* 20-page illustrated brochure describes products. Covers case histories on manufacture of dies, tools, jigs, fixtures, gages, and special machinery.

9 CUTTING FLUIDS—*S C Johnson & Son, Inc, Racine, Wis.* 16-page booklet "Cutting & Grinding With Johnson's Wax Cutting Fluids" describes properties of wax as applied to cutting functions. Contains comparative machinability table as guide to selection of correct coolant for every grade of metal. Covers complete line of cutting and grinding water soluble coolants and cutting oils.

10 INDUSTRIAL DIAMOND PRODUCTS—*Diamond Tool Research Co, New York 10, NY.* 14-page file folder, catalog 5, contains illustrated descriptions of diamond dressing and truing tools, cutting and boring tools, powder, compound, and plated mandrels. Price lists and selection data included.

11 SINTERED CARBIDE—*Firth Sterling Inc, Pittsburgh 30, Penna.* 4-page bulletin discusses TXL, a specially designed grade for machining of steel from finishing cuts to the medim roughing range of operations. Covers cutting characteristics and performance reports.

12 ELECTRICAL INDICATING INSTRUMENTS—*Simpson Electric Co, Chicago 44, Ill.* 87-page technical manual 17 illustrates and describes complete line of instruments and test equipment. Panel meter section covers 800 different kinds and sizes, with wiring diagrams, dimensional drawings, technical and design features, characteristics described.

13 OPTICAL COMPARATOR — *Covel Manufacturing Co, Benton Harbor, Mich.* 4-page bulletin 1456C describes Model 14. Design, construction features, and applications illustrated; specifications and attachments included.

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14 THERMOSWITCH CONTROLS — *Fenwal Incorporated, Ashland, Mass.* 4-page illustrated catalog MC-124A on miniaturized and surface-mounted thermostats gives physical, electrical, and performance data for several popular types. Summary of design and installation factors which can affect control accuracy included.

15 NONDESTRUCTIVE TESTING — *Magnaflux Corp, Chicago 31, Ill.* 13-page illustrated booklet "Seeing Isn't Always Believing" (new edition) includes information on Magnatest electronic eddy current and magnetic sensing instruments; Spotcheck dye penetrant; Magnaflux-Magnaglo equipment; fluorescent penetrants.

PLANT SERVICE EQUIPMENT

16 STORAGE RACKS—*American Metal Products Co, Detroit 4, Mich.* 28-page plastic-bound catalog covers complete line. Applications illustrated, capacity charts, accessories, construction features discussed.

17 OVERHEAD CRANES — *Chicago Tramrail Corp, Chicago 23, Ill.* 16-page bulletin U-200-1 contains illustrated data on underhung units. Capacities, dimensions tables, applications, and accessories covered for line including push-type flexible bridge, and standard, hand-geared, and various modifications of motor-driven types.

18 FANS—*Detroit Blower Corp, Franklin Park, Ill.* 20-page illustrated bulletin DAF-101 contains performance curves, specifications, design features, for new line of axial flow units powered directly and through belt drives. Models include individual, floor-stand coolers; extended shaft units; cradle-slung floor models; and large fans for heavy usage.

19 MACHINERY MOUNTS — *Barry Controls Inc, Watertown, Mass.* Illustrated folder outlines 18 case histories of users of Barry mounts from installation of a 400-ton punch press to vibration isolation for a sensitive optical system built into a visual grinder. Advantages discussed.

20 VIBRATORY MATERIALS HANDLING EQUIPMENT—*Syntron Co, Homer City, Penna.* 50-page condensed catalog 564 contains technical data and illustrated descriptions of vibrators, feeders and screens. Data also included on company's shaft seals, selenium rectifiers, and power tools.

21 AIRBLAST CLEANING CABINET —*Pangborn Corp, Hagerstown, Md.* 8-page brochure 607 pictures and describes the EN-2 for small or intermittent work. Features, dimensions, specifications, applications covered.

22 BATTERY TRUCK MOTOR—*General Electric Co, Schenectady 5, NY.* 6-page illustrated bulletin GEA-6532 gives design, construction, and application features of new traction motor for low-voltage electric vehicles. Includes performance data, available ratings, and mounting information.

23 TUMBLING ABRASIVES — *Exolon Co, Tonawanda, NY.* 4-page folder contains information on solid aluminum oxide abrasive for barrel finishing. Finished parts illustrated; selection data, and recommended procedures discussed.

PARTS AND MATERIALS

24 VARIABLE SPEED DRIVES — *Worthington Corp, Harrison, NJ.* 15-page bulletin 1600-B7 P illustrates and describes Allspeed drive with touch control, available in sizes from 1/3 through 5 hp. Features, operating principle, design, component parts, definition of engineering terms and formulas, selection tables, and dimensions covered; applications and accessories included.

25 REYNOLDS ALUMINUM DIGEST *Reynolds Metals Co, Louisville 1, Ky.* Illustrated publication (32-36 pages) available monthly contains reviews of articles relating to aluminum that have been published in the technical press during preceding 30-60 days. Includes statistics on aluminum industry, patent listings, new products and markets.

26 SOLENOID VALVES — *Automatic Switch Co, Orange, NJ.* 32-page condensed catalog 201 presents illustrated descriptions of line of 2, 3, and 4-way units. Contains engineering information, flow charts, operation and construction details, prices, and selection data.

27 STAINLESS STEEL, NICKEL AND NICKEL ALLOY TUBING—*J Bishop & Co Platinum Works, Stainless Steel Products Div, Malvern, Penna.* 12-page illustrated catalog on cold drawn mechanical, capillary, hypodermic stainless from 0.008 to 1 in. OD, and nickel and nickel alloy tubing, covers specifications, standard tolerances, comparative analysis, physical properties, and relative workability.

28 MOTORS—*Marathon Electric Manufacturing Corp, Wausau, Wis.* 300-page condensed catalog contains complete cross reference between old and new NEMA ratings, both horsepower and dimensions. Covers current pricing for 1/20 through 1000-hp motor sizes on both fractional and integral hp units.

29 DIRECTIONAL CONTROL VALVES—*The Oilgear Co, Milwaukee 4, Wis.* 16-page illustrated bulletin 80300 gives details on 3 and 4-way units for fluid power systems up to 3000 psi. Construction features, and functions of standard and special plungers included; covers mechanical, manual, hydraulic, and solenoid pilot models.

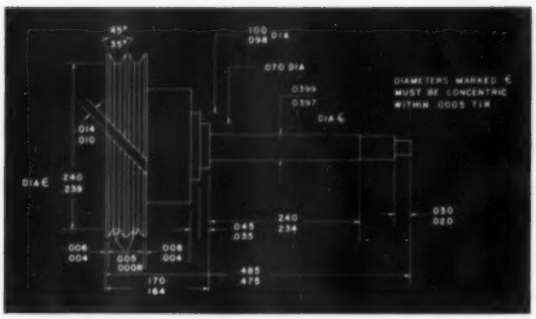
30 THERMISTORS—*Federal Electronics Inc, Framingham, Mass.* 12-page catalog EMC-1 contains dimensional drawings, physical descriptions, and electrical specifications for various forms, including beads, rods, disks, washers, and built-up assemblies. Applications illustrated.

MISCELLANEOUS

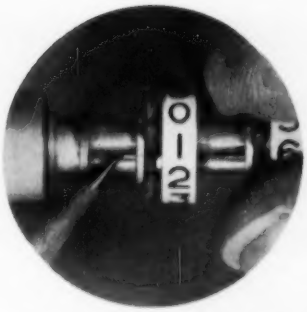
31 SINTERED METAL PARTS — *Burgess-Norton Mfg Co, Geneva, Ill.* 4-page illustrated brochure describes production facilities for making Quali-Sint powder metal parts. Equipment, process, and service covered; advantages outlined.

32 CUSTOM MOLDED RUBBER PRODUCTS — *Chicago-Allis Mfg Corp, Chicago 7, Ill.* 15-page illustrated catalog describes design, engineering, and manufacturing facilities for production of products of natural, synthetic, and silicone rubber; hydraulic and pneumatic leather packings, transmission beltings; and shaft and face seals of various materials.

AMERICAN MACHINIST, 7-16-56 Not good after Sept. 16, 1956



Inspection of incoming precision shafts took 10 to 15 minutes each by mechanical gaging—involved concentricity, diameters, shoulder locations, and other tough-to-measure dimensions to tolerances of .0002". Doing the work on a Kodak Contour Projector cut time to 2 to 3 minutes per shaft.



The problem was to check many small calculating machine parts averaging about 13 critical dimensions for each with shapes mostly complex. With carefully engineered mechanical gages, inspection time averaged 50 seconds each. Optical gaging on a Kodak Contour Projector brought the average down to 12 seconds.

Spacing the parallelism of a special tuning condenser for electronic test equipment had to be held to very close tolerances. "Use of the Kodak Contour Projector," the company reports, "permits economical measurements of parallelism to an accuracy impossible to obtain by other methods."

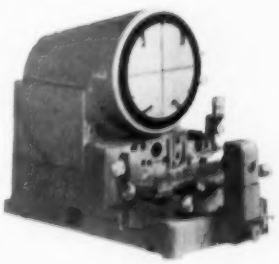
On a flexible rubber-like part, rejects ran as high as 30%. By using a Kodak Contour Projector to measure the parts and then plotting results by statistical quality control methods, production changes were made that resulted in rejects dropping from 30% to less than ¼ of 1%. Optical gaging eliminated distortion of the part while gaging, and proved 4 to 5 times faster than usual methods.

One instrument inspects these varied parts

Here is another economy optical gaging can provide: switching from one part to a second part requires only a change of chart and fixture. You still use the same basic instrument. And with a Kodak Contour Projector, the variety of parts you can check is almost without limit. Here's why:

1. *Capacity*—Screen size on an optical comparator does not restrict the size of parts you can handle, for multiple-position fixtures allow the handling of parts larger than the screen itself. What's important is the staging area—and Kodak's unique relay lens provides uniform ample clearance regardless of magnification. The distortion-free image lets you measure anywhere on the viewing screen. The choice of lenses, of horizontal or vertical projection, and of surface or shadow illumination gives you the greatest possible flexibility.
2. *Ease of operation*—Kodak Contour Projectors are designed for maximum speed and minimum operator training. The bright screen image reduces fatigue, lets you use the instrument in normal room light. Images are erect and unreversed at all magnifications. Finger-tip controls are within convenient reach of the operator.
3. *Optical stability*—The adjustment-free optical elements on Kodak Contour Projectors eliminate the need for operator adjustments. Rigidly mounted lenses and mirrors maintain alignment and position. Rugged construction withstands rough and heavy use.

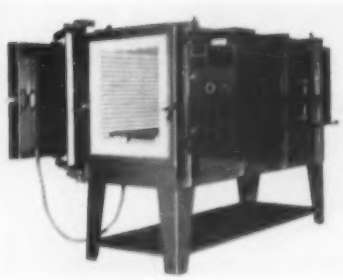
Whether you are now using optical gaging or just considering it, you should have a copy of the booklet, "Optical Gaging with Kodak Contour Projectors." It gives complete details on Kodak optical gaging equipment and how it can work for you. Write to *Special Products Sales Division.*



EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak



Furnace Has Six Zones, Each Separately Controlled

Model P2472-1 special furnace is designed for heat-treating operations where furnace gradients must be closely controlled. Interior dimensions are 24 in. wide by 24 in. high by 72 in. long.

Different temperatures in different parts of the furnace are easily controlled and indicated by means of a thermocouple selector switch. Furnace has six zones, with input to each controlled by a device which may be set from 7 to 100% of input in increments of 1%, giving precise control over the rate of heating in that zone. Any rate of heating-up time may be selected, enabling control over product uniformity.

Automatic control is attained by a combination of temperature controller with "straight-line" adjustments and a thirty-hour timer. Controller upon its first impulse starts timer; when timer has "timed out" the furnace is automatically shut off. At this point variable cooling off may be selected by setting the controller to the desired rate.

Elements are supported by means of special Dyna-Glow holders, which are said to have excellent heat-transfer properties.

L & L Mfg Co, 136 8th St, Upland, Delaware Cty, Penna

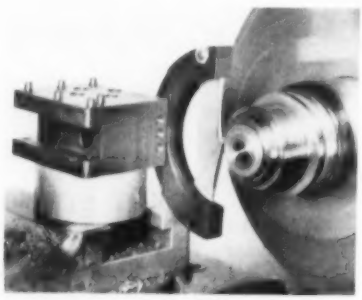
Metal Lubricant Simplifies Machining of Hardened Steels

Designed for use in the machining of stainless and case-hardened steels, lubricant called Metalube is reported effective in drilling, tapping, reaming, and broaching operations. Material contains no white lead or other toxic additive, will not injure the skin.

Maker stresses economy of lubricant: on tapping operations, one drop per tapped hole is usually sufficient. For convenience of user, lubricant is packaged in collapsible aluminum tubes, and is offered in viscosities to meet requirements of any production machine. Price per tube is 90¢; dozen lots are available at $6.

Protective Coatings, Inc, Box 3985, Detroit 27, Mich

FLUSH-PIN AMPLIFIER with a ratio of amplification of 5 to 1 has the same characteristics as the plain flush-pin gage, but can produce tolerances as far down as 0.001 in. Three hardened-steel balls are held by a retainer 120° apart about the cone-shaped end of the slidingly disposed pin. When activated to move against the female cone angle inside housing, balls advance toward pin, causing it to move upward by a new ratio which is the result of a trigonometrical function between male and female cone angles. Gaging method eliminates setting master, mounting bracket, dial indicator, and protective housing—*A M DeLeo Engineering Corp, 18220 W 7 Mi Rd, Detroit 19, Mich*

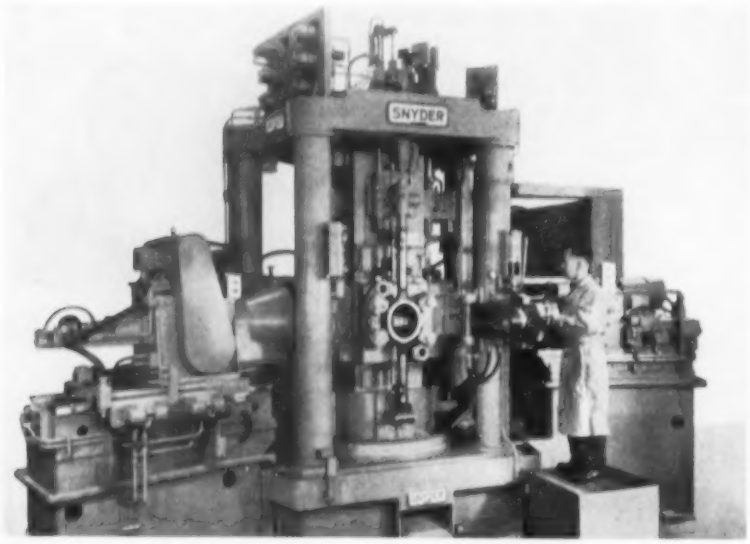


Wye-Stanley Cutoff Tool Fits Lathes, Automatics

Speedway is designation for cutoff-tool assembly designed for use on lathes and automatic screw machines. Construction of tool eliminates the overhang problem by supporting the cutting edge by tension rather than bending moment. This design permits the use of a much thinner blade in relation to depth of cut.

Vertically hung blade is said to eliminate tool chatter, as well as to create less heat, thus ensuring longer life. Reportedly especially stable on interrupted cuts as well as suited for work on blanks of all kinds, tool blades and holders are available for cuts up to 4½ in.

Wye-Stanley Tool Co, 3503 E Olympic Blvd, Los Angeles 23, Calif

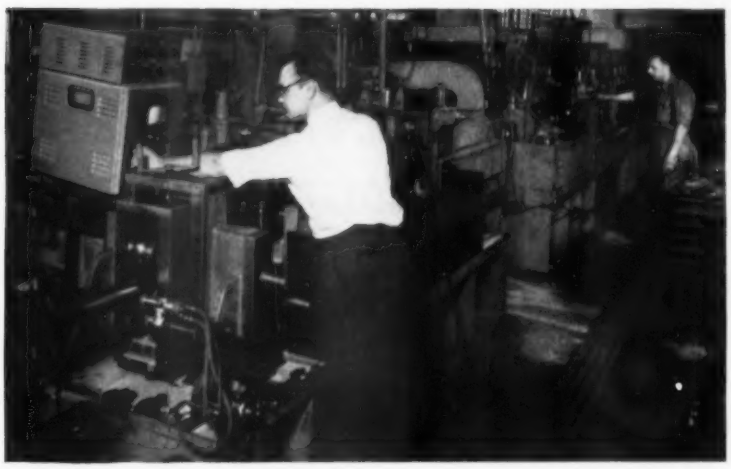


AUTOMOTIVE AXLE HOUSINGS are machined on five-station vertical-trunnion index machine designed to cut floor-space requirements for machining long parts. Center-column unit holds the work fixtures and rotates parts from station to station. Hydraulically operated, electrically controlled unit rough- and finish-faces the housing banjo flange, drills and reams ten holes in the flange mounting face, and chamfers both sides of the holes, producing 105 housings per hour at 100% efficiency. Machine is 13 ft high, occupies floor space of about 214 x 148 in.—*Snyder Tool & Engineering Co, 3400 E Lafayette, Detroit 7, Mich*

Sperry

ultrasonic inspection news

AUTOMATIC INSPECTION AND CONTROL ON CONTINUOUS PRODUCTION LINE



Continuous inspection of steel tubing and strip at production speeds is now an accomplished fact with the new Sperry Ultrasonic Reflectoscope® and RA attachment. This unit scans material traveling at high speeds and registers the presence of both internal and surface defects. Far more thorough than the human eye, it provides for both defect recording and signaling in addition to continuous inspection. Designed to incorporate signal lights or alarm bells, as well as automatic marking and machine cut-off units, the Sperry Reflectoscope and RA attachment is a flexible, accurate instrument which opens a new area to more effective cost-cutting quality control.

THE SHOW'S ON THE ROAD!

Sperry's new ULTRASONIC CARAVAN is now on a nationwide tour of plants and factories throughout the United States.

The Caravan's compact exhibits will demonstrate every aspect of ultrasonic testing and equipment to management and engineering personnel. You will see all types of Sperry Reflectoscopes, signaling and recording devices — in action... in your own plant... using samples of your own materials or products for testing!

If you are located in one of the nation's larger industrial centers, the ULTRASONIC CARAVAN is probably already scheduled to visit your plant. If not, your Sperry Representative will be glad to discuss the possibility of a visit to your plant or area. Return coupon for itinerary of the ULTRASONIC CARAVAN.

AM-7

Sperry Products, Inc.
600 Shelter Rock Road
Danbury, Connecticut

Please tell me when the Ultrasonic Caravan will be in my area.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

sperry products INC.

FIRST IN ULTRASONIC INSPECTION

DANBURY, CONNECTICUT

To keep posted on latest developments in the profitable use of ultrasonic inspection by industry send for your copy of our new Ultrasonic Inspection News Letter.

Barth Brakes Are Offered In Plain or Universal Types

Series of improved brakes for bending and shaping sheet metal is offered in the following types:

Plain brakes, for general use in sheet-metal shops, are available in sizes of 4, 6, 8, and 10 ft.

Universal brakes have same action and scope as plain brakes, but with various combinations of fingers in place the length of the bending edge is varied to accommodate different sizes of boxes, pans, and trays. Units are made in 4-, 6-, and 8-ft sizes. Finger extension is 6 in. and standard finger widths are 3, 4, and 5 in.

Combination-brake series, which consists of lighter-gage machines adaptable to either of the above-mentioned types of work, is made in 3- and 4-ft sizes. Finger extension is 4 in.

Bench brake is designed for small job shops, and is made in 3- and 4-ft sizes, with capacity rating for ⅜-in. flange on mild steel.

Barth Engineering & Manufacturing Co, Milldale, Conn

Arc-Welding Line Is Expanded and Improved

Sureweld welding line, which numbers 10 different types and 98 models, has been expanded to include the following:

DC rectifier welder group includes DRCV Series constant-voltage welder, for use in inert-gas metal arc-welding; DRGA Series, designed for maximum crater elimination; DRH Series, featuring horizontal styling and single current range; and company's standard general-purpose dc rectifier.

Series SGW portable, air-cooled, engine-driven dc unit is rated at 200 amp, 30-v dc current (50% duty cycle) and will handle 3/16-in.-dia electrodes. 1500-w ac power take-off is added for operating such things as electric-power tools and auxiliary lighting.

Inert-arc ac welder group includes ACGA-220 Series welder, with mechanical current control, available in 140, 200, and 300-amp models; ACGA-250 Series welder, with electrical current control, available in 150, 235, and 350-amp models; and the GAMA Series, with electrical current control, equipped for ac and dc metal-arc welding in addition to inert-arc welding.

AC industrial welder, the ACHD Series, is made in 5 models with 60% duty-cycle ratings of 200, 300, 400, 500, and 600 amp.

National Cylinder Gas Co, 840 N Michigan Ave, Chicago 11, Ill

Hyster Lift Trucks Offered In Pneumatic-Tire Models

Gasoline-powered lift trucks with capacities of 3000, 4000, and 5000 lb reflect automotive trends with their low silhouette, automobile-like controls, and greater operator comfort and faster speed of operation. Pneumatic-tired units have brakes self-energizing in both directions, with a total of 125 sq in. of braking area.

Load-lifting speed of 5000-lb model is 48 fpm; 3000- and 4000-lb trucks lift at rate of 50 fpm. All models have forward-travel speed of 13.8 mph.

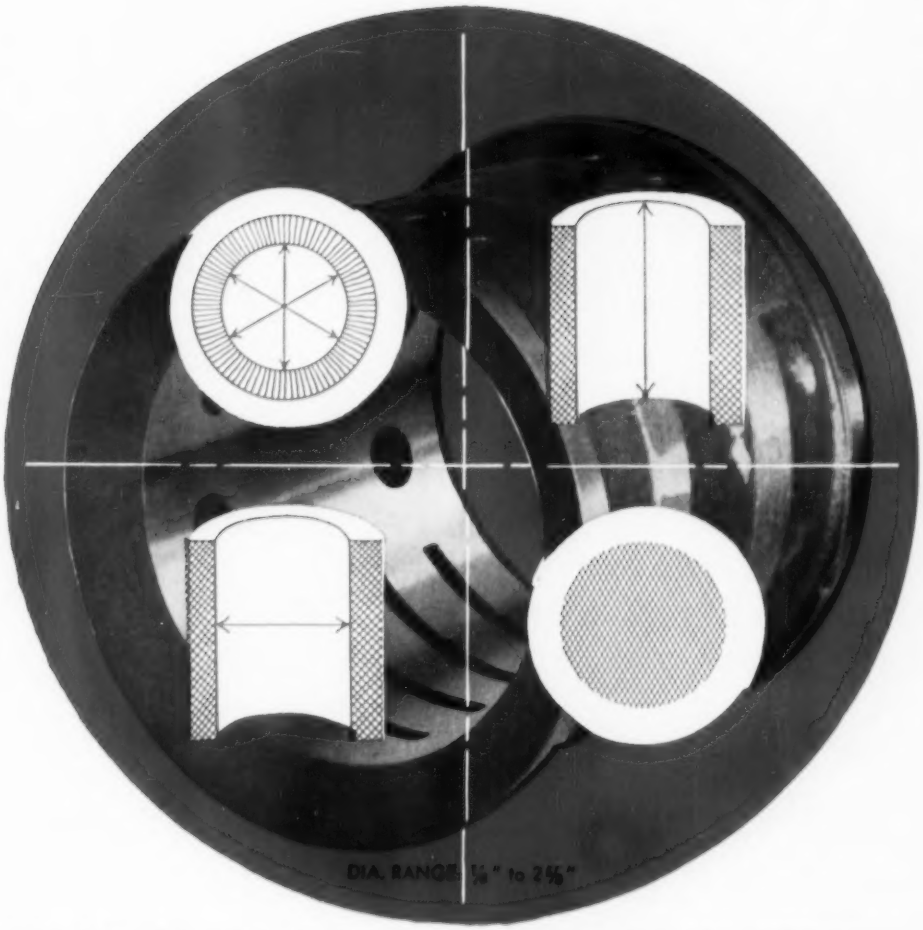
Optional features include power steering, Hystamatic fluid torque converter drive, LP-gas installation, dual front wheels, and company's Monomast upright assembly.

Hyster Co, 2902 NE Clackamas St, Portland 8, Ore

Air washers of rubber-lined, acid-proof design are intended for integration into plant ventilation systems, and are said to be capable of eliminating 90-to-99% of toxic fumes and corrosives from exhaust gases. Standard units are available in capacities of from 7200 to 57,600 cfm. In operation, a special vertical packing bed is irrigated from the top with a liquid (usually water), which is distributed throughout the bed from calibrated drip points which give uniform wetting. This arrangement presents a blanket of wet surface area to the passing air or gas.

Automotive Rubber Co, Inc, 12500 Beech Rd at PMRR, Detroit 39, Mich

AUTOMATIC THREADING LATHE from Italy, Model 1240, is offered in a redesigned version which supersedes previous models. Single-point, high-speed machine automatically cuts internal and external threads, right and left-hand, taper and multi-start. Unit is approx 1000 lb heavier than previous models and is equipped with a secondary gearbox for producing multi-start threads. It also features a multi-feed attachment which enables operator automatically to duplicate 2, 3, 4, or 6 passes when cutting multi-start threads. Pressure indicator built into tailstock live center allows operator to determine tool pressure and heat distortion. Machine has capacity of up to 55-in. of thread length and will swing up to 12 in. in dia. Working speeds range to 2000 rpm—*Imported by Man-Au-Cycle of America, 132 53rd St, Brooklyn, NY*



FOUR-DIMENSIONAL HONED HOLES... ACCURATE ALL WAYS

IN DIAMETER—Semi-skilled operators can bring the hole up to final size quickly . . . with production tolerances of .0002" to as close as .000025", if required.

IN ROUNDNESS The work centers itself on the mandrel . . . producing a perfect, **geometrically** round hole.

IN STRAIGHTNESS Levels all internal irregularities for **end-to-end precision.** Corrects taper, waviness, hourglass and barrel shapes.

IN SURFACE FINISH Guarantees specific surface finishes as required . . . as fine as 2 micro-inches RMS in hardened steel.

SUNNEN HONING ASSURES EQUAL DISTRIBUTION OF BEARING LOADS—LONGER LIFE OF MATING PARTS

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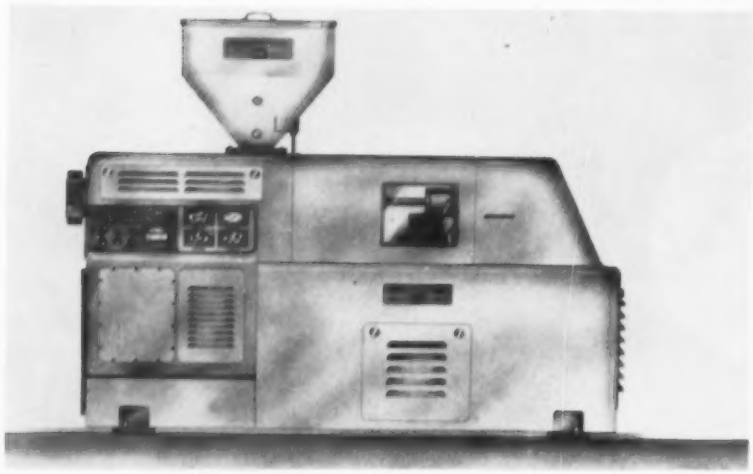


Reed-Prentice Plastic Extrusion Machine Heats Only Front Portion of Screw

In the Autoflow 100H plastic extruder, the plastic material is under heat for a relatively short time, because only the front portion of the screw is heated. Maker points out that this feature is particularly important in extruding heat-sensitive material such as vinyl. Because most of the screw length is used only to convey material in granular form, little horsepower is required for the machine—only a 5-hp motor to extrude 100 lb per hour.

Machine operates in the following manner: Material is fed from a hopper into the screw barrel. Flights on the hollow screw convey material up to a heated cone baffle. Material becomes plasticized by the milling action of the tapered flights on the front end of the screw against the heated baffle, then internally extrudes through a series of ports at the front end of the screw into a cavity in the hollow screw just ahead of the plunger. Plastic then extrudes out through the die.

Hollow screw design incorporates a plunger inside the screw which acts as a dampener through controlled air pressure; damping action smooths out fluctuations caused by the screw flights, producing a more uniform product. Plunger can also be used to control working die pressure, change character of the screw (by covering or uncovering various ports), purge material while screw is being cleaned, and push out or retract screw for machine cleanup.

Separate floor-mounted cabinet houses electrical controls and two proportioning-type pyrometers.

Reed-Prentice Corp, Worcester 4, Mass

Powdered-Metal Rolling Mill Produces 50,000-lb Force

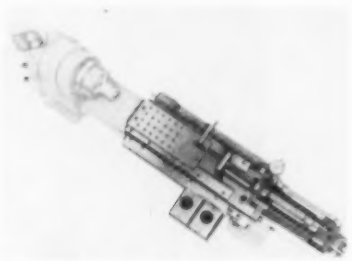
Model FH-400 machine for rolling metal powders into strip has chrome-vanadium alloy-steel cold rolls of 6-in. diameter by 6-in. face width. Rolls are arranged horizontally and turn on cage-type needle-roller bearings; end thrust is taken by radial ball bearings. Designed to withstand great compacting pressures, each roll neck bearing has a load capacity of 25,000 lb, equal to a maximum roll separating force capacity of 50,000 lb.

An additional set of chrome-moly-tungsten alloy-steel hot rolls may also be furnished if the application calls for work at elevated temperatures. To obtain internal heating, such hot rolls may be fitted with cartridge elements which heat the rolls.

Roll adjustment is made by means of a handwheel, provided with lifting studs which permit positive control of the roll setting in either direction. Graduated dial provides micrometer adjustment of the setting, and a clutch is provided to aid in establishing roll parallelism.

Unit is powered by a 5-hp, four-speed gearshift drive which operates at speeds of 10, 20, 30, and 40 rpm. Emergency stop panels are located on front and rear of machine.

Stanat Mfg Co, Inc, 47-28 37th St, Long Island City 1, NY



Boring-Turning-Facing Attachment

Exactomatic, a toolholder mounted on hardened, precision-ground ways and equipped with both pneumatic and hydraulic action, converts any standard lathe into a high-speed, semi-automatic production tool. Adjustable stops control length of cut and depth of bore.

In operation, the tool carriage is rapidly moved into cutting position by an air cylinder. Control of carriage is then taken over by a hydraulic cylinder which precisely advances tool at the prescribed feed rate, which is infinitely adjustable. At the completion of the cut, tool is rapidly retracted by the air cylinder.

Once set up, device is operated by a pushbutton switch, which starts the cycle. Two general-purpose toolholders and a dial indicator are provided as standard equipment.

Additional features: micrometer adjustment of carriage permits tolerances of 0.0002 in. or less and holds taper to zero; unit can be mounted at any desired angle on the toolholder plate; device is available in different models and strokes, including compound units which will bore and face simultaneously.

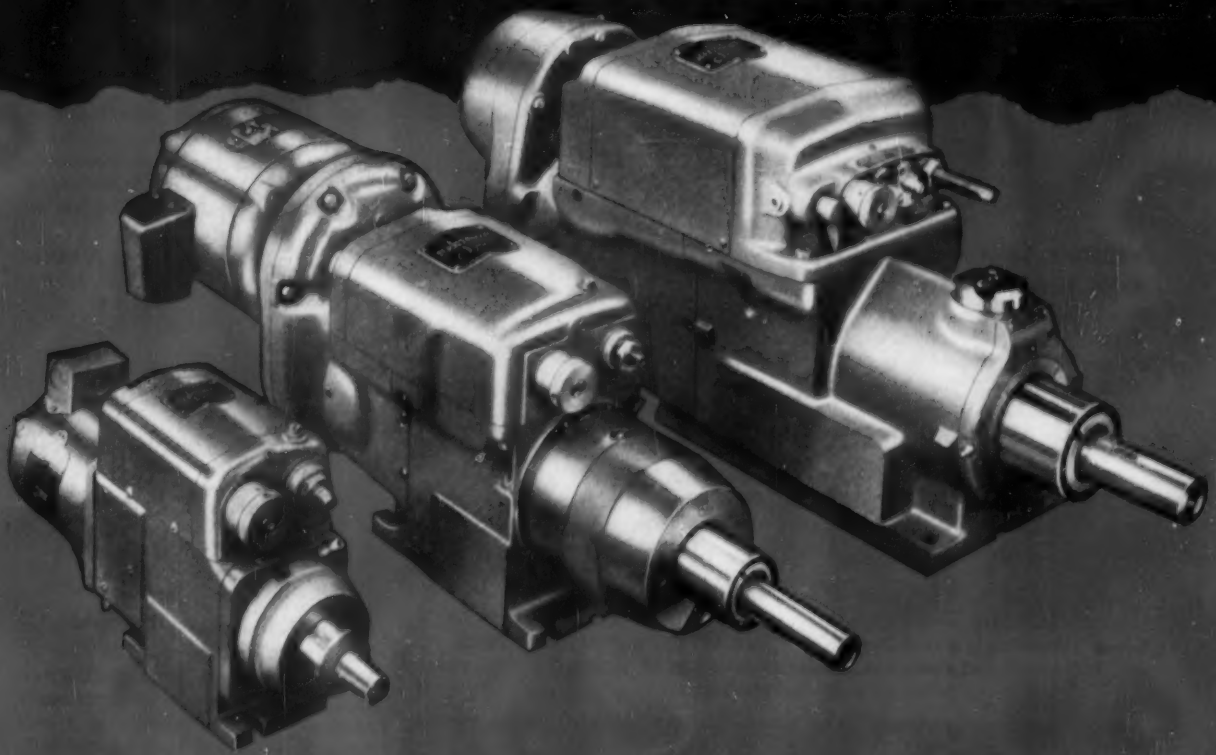
Exact Level & Tool Mfg Co, Inc, High Bridge, NJ

Servo motor tachometer generator, MG-3088, has no-load speed of 19,600 rpm and is designed for continuous operation at 140 C ambient temperature. Unit measures 1.03 in. max dia by 2.156 in. long, weighs 4.6 oz.

John Oster Manufacturing Co, Avionic Division, Racine, Wis

HARTFORD *Special*

COMPLETE DRILL UNIT LINE!



CONDENSED SPECS . . . 3 Models, 15 Drive Arrangements

Model No.	Drilling Capacity Mild Steel	Tapping Capacity Steel	Maximum Stroke	Horse Power	Spindle Speed Range	Feed Range	Rapid Approach Rate	Rapid Return Rate	Standard* Spindle Nose
19-150	5/16" dia.	3/8"	1½"	⅓ to ¾	300 rpm to 10,000 rpm	0-70 ipm	350 ipm	300 ipm	#2 Jacobs external taper
19-400	⅝" dia.	⅝"	4"	¾ to 2	100 rpm to 5,000 rpm	0-50 ipm	300 ipm	240 ipm	#2 Morse internal taper
19-600	1¼" dia.	1"	6"	1½ to 5	28 rpm to 3,450 rpm	0-180 ipm	Adj. to 300 ipm	Adj. to 240 ipm	#4 Morse internal taper

* Special spindles available on request.

If in your plant you drill, tap, ream, spot-face, center, hollow mill, chamfer or counter-sink and you want to cut costs, send for this catalog . . .

MACHINE TOOL DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
2827 Homestead Avenue, Hartford 12, Conn.

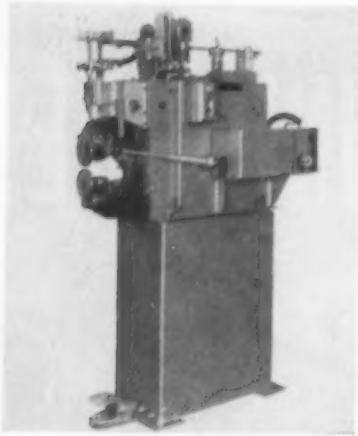
☐ Have Field Engineer call.
☐ Send Application Data Sheet and descriptive Bulletin.

Name _____

Company _____

Street _____

City _____ Zone _____ State _____



Resistance Seam Welder Welds Within 0.002 in.

Type OS bench resistance seam welder, formerly produced in special designs only, is offered as a standard model. Unit has adjustable welding current and pressure for welding a wide range of metals, such as stainless steels, Inconel, Monel, Nichrome, titanium, nickel-silver, beryllium-copper, and certain bronzes and brasses. Gage limits, varying with individual metals, are from 0.002 to 0.020 in.

Applications include welded assemblies for diaphragms, electron tubes, submersible-pump motor liners, and other components requiring precision welding of thin, critical metals. Company builds its own electronic controls for the welder.

To conserve space, unit is built on a very narrow frame. Five electrode wheel-drive arrangements are available: single gear, single or double knurl, and single or double friction drive. Machine can be equipped with circumferential, longitudinal, or universal welding-head arrangements, using either straddle-bearing or cantilever-mounted welding heads.

Sub-base permits floor mounting of the welder. External flood jets, individually controlled, cool the electrodes, and a water drain permits inspection of interior cooling circuits.

Taylor-Winfield Corp, Warren, Ohio

Press Safety Control Functions on "Stored Energy"

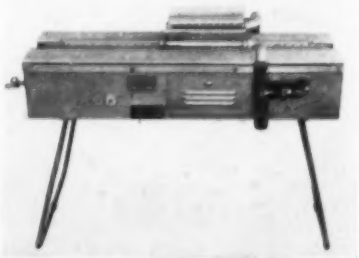
Model SCI-200-1, an electrical safety control for mechanically tripped machines and presses, is interchangeable from one machine to another. Device functions on "stored energy": When hand buttons are depressed the line voltage is disconnected and the stored energy is released to operate an air motor or electric solenoid.

Both hand buttons must be released to permit recharging the capacitor to produce stored energy for the next machine cycle. Control cannot be cheated by tying down one button and operating with he other, or by short circuiting.

Control also incorporates a time delay adjustment that permits changing the time interval between the depression of the first and second hand buttons. Feature provides a means for gradually guiding a new operator into efficient, rhythmic production, also applies where more than two control buttons are used to operate a machine.

In addition to non-repeat operation, system can be changed by a selector switch to repeat operation. By this method the press continues cycle as long as the handbutton or footswitch is held down.

Security Controls, Inc, 243 Franklin St, Buffalo 2, NY



Multiflame Brazing Machine Handles Parts 10 in. Wide

No. 20-2 Y-B multiflame brazing machine, a modification of previously announced larger models, is a unit for semi-automatic brazing and soft-soldering which can also be used for tempering, annealing, and hardening. Only 60 in. long, 24 in. wide, and 34 in. high, it can be fitted into any production line.

Machine operates on manufactured, natural, or LP gas, with conventional shop airlines supplying air pressure. Unit uses standard flux and preform solder forms. A regulated conveyor belt establishes production speeds.

Materials move through a heating zone that can be adjusted to accept materials up to 10 in. wide and 30 in. high. Burner manifolds can be adjusted to allow angling flames for the most complex joinings.

Where highly complex or multiple joinings demand, rotating work tables can be added to the conveyor belt to revolve work within the heating zone. Fixtures for holding work attach to conveyor belt and can be furnished through the company. Machine retails under $1000.

Youngberg Bros, Meriden, Conn

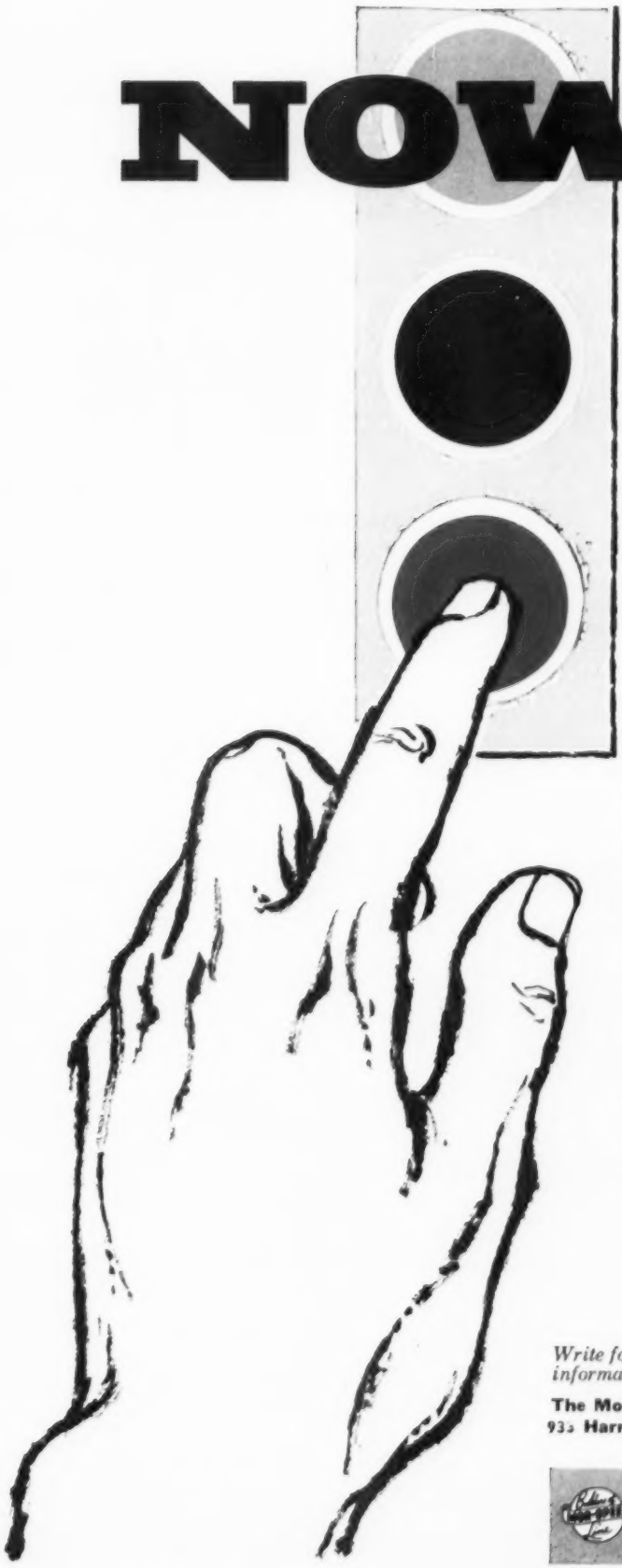
KIRKSITE MELTING FURNACE of nose-tilting type is a special unit with 25,000-lb capacity built for a California aircraft company. Furnace is 76 in. in dia and 37 in. deep. Nose-tilting feature eliminates the necessity for a deep pit, because the ladle rests on the same floor level as the furnace. Great size of furnace permits large scrap dies to be remelted without first being cut up. Oil-driven tilting mechanism is sensitively controlled by a lever-operated valve—*Bellevue Industrial Furnace Co, 2620 Crane, Detroit 14, Mich*

NOW...

PUSH BUTTON RADIAL DRILL OPERATION

with the All-New Morris

Hydra-Power RADIAL DRILLS



Push buttons replace conventional levers and controls to make operation of these new 13" and 15" MORRIS Hydra-Power Radial Drills the easiest and fastest ever offered!

Pushing a button raises or lowers the arm; traverses the head left or right; clamps or unclamps the arm, head or column . . . even shifts the gears in these rugged new radials!

- Completely push button controlled
- Hydraulically actuated operations
- All buttons in single panel
- Completely integrated electro-hydraulic control system
- Pre-selection of spindle speeds and feeds
- Designed for rigidity and accuracy
- Full safety features
- Hydraulic gear shifting

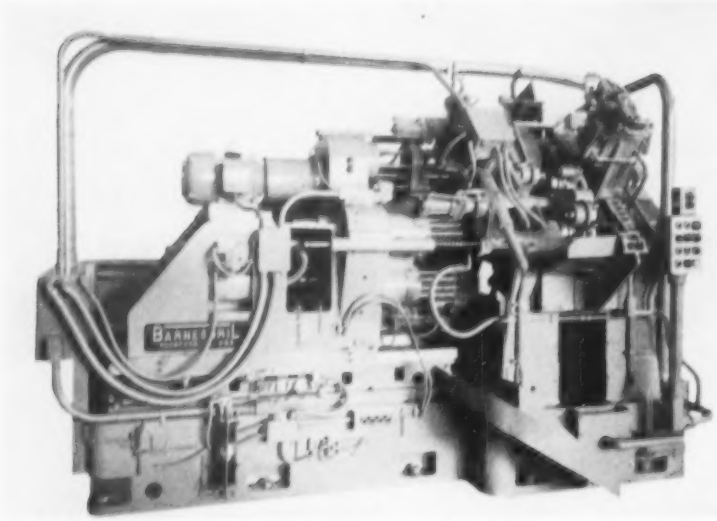
Other important Morris Hydra-Power features:

- Automatic tool ejector
- Built-in electric light
- Adjustable spindle counterbalance
- 36 Spindle speeds; 4 ranges
- 18 Feeds, including 8, 11½, 14, 18 and 27 thread leads

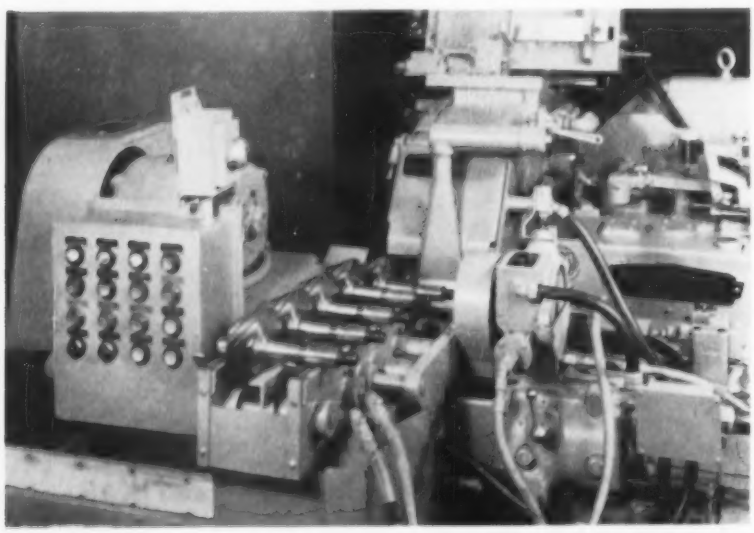
Write for complete detailed information and prices!

The Morris Machine Tool Co.
933 Harriet St., Cincinnati 3, Ohio

Morris



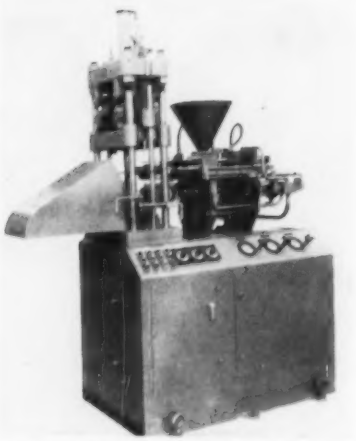
REAR-AXLE DRIVE GEAR is machined on special eight-station drum-type unit, which produces 200 parts per hour at 80% efficiency. Gears are delivered by conveyor to loading pocket on machine; work is automatically picked up by loading arm and moved into position and clamped. Operations performed include drilling, chamfering, reaming, and tapping. Automatic gaging is provided after drilling operation—*Barnes Drill Co, Rockford, Ill*



AUTOMOTIVE STEM PINIONS are ground on special automatic machine with features which include special workholding and driving equipment with automatic loading and unloading devices. Parts are loaded in a chute which automatically moves them down inclined ways toward a revolving turret, which then places each pinion in position for the footstock center to engage the center hole and push it forward into a floating-type collet on the headstock. Upon completion of grind, revolving turret takes pinion from centers and discharges it into an unloading chute. Grinding-wheel truing is automatic at predetermined intervals by a wheelhead-mounted device—*Norton Co, Worcester 6, Mass*

Molded plastic handle for machine tools, dies and fixtures, and other uses, incorporates a steel core for tight fit and easy, fast assembly. Available in 7/16 in.—20 and ½ in.—20 UNF sizes.

Chicago Screw Co, 2701 Washington Blvd, Bellwood, Ill



Stokes Injection Molder Combines Vertical Clamp, Horizontal Comb

Model 701 automatic injection-molding press of vertical design is a two-ounce machine which can be applied to a wide variety of molding applications. With vertical clamping combined with a horizontal combing action, the de-gated parts can be ejected horizontally onto a conveyor instead of being dropped into bins; the danger of damage to finely molded pieces is thus reduced. Barriers can be incorporated into the horizontal comb to guide the separate pieces of a multiple-piece mold into separate bins.

Either top or bottom ejection of the molded pieces is possible, because of the use of top hold-down pins, top knock-out pins, and bottom knock-out pins. Knock-out cylinders are hydraulically operated, independent of the moving ram.

Hot runner molds provide positive shut-off at the mold. Positive shut-off at the injection nozzle is also incorporated in the design, which permits the molding of nylon without stringing or nozzle change. Feature also permits full pressure prepacking of the injection cylinder, simultaneous with the cooling cycle.

Machine has an automatic cycle of only 3.5 sec from the time the mold opens until it starts to fill again. Self-contained unit requires 18 sq ft of floor space.

Because manual unloading, degating, and sorting are eliminated, one operator can handle as many as ten machines. All operations are timed to occur in the proper sequence. If parts do not eject, a microswitch control prevents mold damage by holding the machine at the low pressure level.

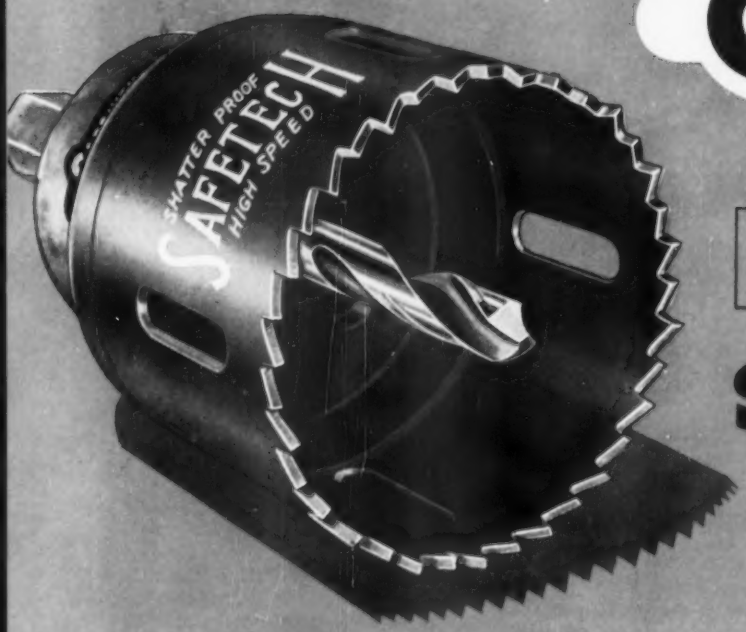
F J Stokes Machine Co, Inc, 5500 Tabor Rd, Philadelphia 20, Penna

stop

and now...

1881 CAPEWELL

SHATTER PROOF SAFETECH® HIGH SPEED



hole saws

Now the famous Capewell line of Metal Cutting Saws has been joined by Capewell *High Speed* Safetech Hole Saws . . . manufactured to the same high standards as Safetech Power Hack Saw Blades . . . a high speed cutting edge with a soft, tough flexible back to give safe, fast cutting in even the toughest materials. Thousands of users know that Safetech Blades stay sharper longer and give more cuts per blade dollar.

Safetech Hole Saws are available from your industrial distributor in diameters ranging from ⅞" to 6". All sizes have six teeth per inch and are equally well suited for cutting sheet, plate or curved sections. Interchangeable arbors with adjustable pilot drills fit chucks from ¼" to ¾". You will find that Safetech Hole Saws are an economical means of extending the useful range of portable power tools, lathes, drills, and production line work.

CAPEWELL'S LINE OF OTHER FINE TOOLS

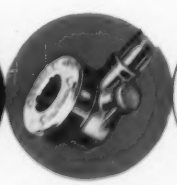
Hand Hack Saw Blades – Three types: Technite, High Speed, and Safetech, in standard lengths and both pitches.

Hack Saw Frames – Lightweight but rigid, assure just the right blade tension for easy, fast cutting.

Power Hack Saw Blades – Technite, High Speed, and Safetech . . . premium blades for maximum production line sawing economy.

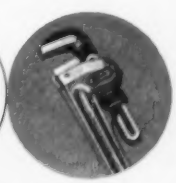
Band Saw Blades – A tooth design and width for accurate cutting from easily cut sheets to the hardest alloys.

Hammers – For both carpenters and machinists, a style and weight for every job. All Technamatic Heat Treated.



Pipe Fitters' Hand Tools – A wide selection to speed the work on pipe, conduit or tubing. Threading, cutting, reaming, vising and flaring.

Ground Flat Tool Steel – Famous Microloy . . . a non-deforming, oil hardening tool and die steel, with close retention to size after hardening.



Wrenches – Jaw openings from ⅛" to 6". Unconditionally guaranteed for life.

SOLD ONLY THROUGH CAPEWELL DISTRIBUTORS who provide: complete inventory . . . engineering assistance . . . delivery when you need it.

75 CAPEWELL

THE CAPEWELL MANUFACTURING COMPANY
Hartford 2, Connecticut

Please send complete details on Capewell Hole Saws to:

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COMPANY _____

ADDRESS _____

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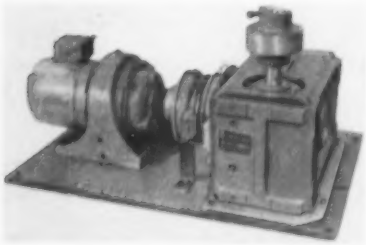
SCA56A



Ferguson Power Unit Offers High-Speed Indexing

Power-indexing unit for straight-line transfer machines or other indexing equipment is made from standard components. Unit, known as the Trans-Pac, includes gearmotor, control-shaft drive sprockets, brake-actuating cam and microswitch, electric clutch-brake combination and mounting ring, indexing mechanism, and drive-shaft coupling. Components are mounted on a steel baseplate.

Indexing mechanism, a Ferguson roller gear drive, features modified trapezoid acceleration characteristics (initial force of zero and a gradual increase to maximum acceleration value) to provide vibration-free indexing. It is rated for a minimum of 8000 hr operation without maintenance, has zero backlash, and an accuracy of 0.001 in.

Gearmotor, of planetary-gear-type transmission, may be one of several brands at the option of the purchaser. Several models of the power unit are available with variations in degrees of angular movement, numbers of stops, and gearmotor output speeds.

Ferguson Machine & Tool Co, Roller Gear Div, PO Box 5841, St Louis 21, Mo

HT-50 MAGNETIC DISK BRAKE is designed so that motor shaft extends through the center and out beyond end of brake, permitting drives off both ends of shaft. Unit can be mounted on NEMA frames 56-C, 66-C, 182, and 184. Details in bulletin 2802—*Stearns Magnetic, Inc, Milwaukee 46, Wis*

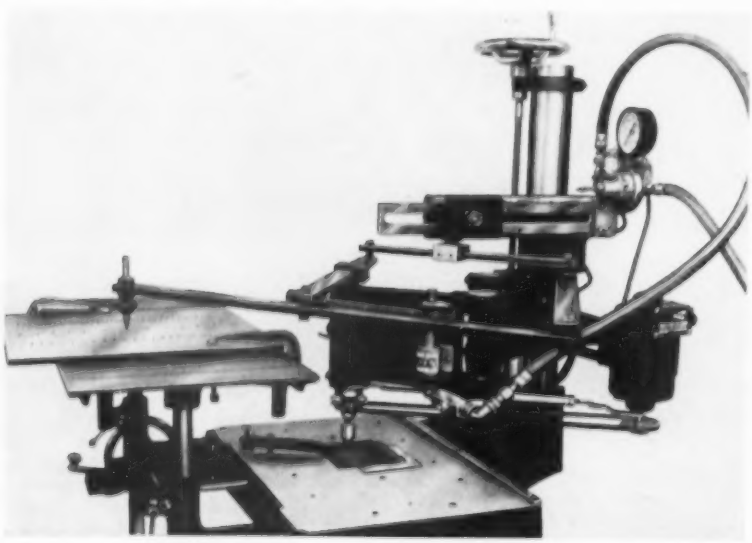
Italian Milling Machines Offered in Three Models

Line of universal dial-type milling machines features hardened and ground spindle and gears, tapered roller bearings, hand-scraped ways, and precision control.

Designated the Westbury line, machines are available in three horizontal models, 1-U, 2-U, and 3-U. Twelve spindle speeds from 28 to 1100 rpm are offered, with dial and hand control for selecting and reversing.

Power is transmitted from the spindle gear box to the feed box in the knee through a vertical shaft mounted on tapered roller bearings. Feed box operates in oil with all feeds selected by dial with a single hand control. All movements can be controlled and operated separately or simultaneously. A single lever will engage the rapid traverse to the longitudinal traverse and vertical feeds by means of a tapered clutch.

Imported by Aaron Machinery Co, Inc, 45 Crosby St, New York 12, NY

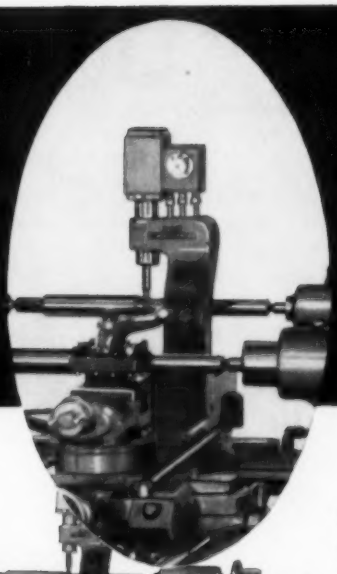


DRILLING OF PRINTED-CIRCUIT PLATES is reportedly speeded by a pneumatic attachment to New Hermes pantograph machine. Speeds of more than 100 holes per min are made possible by a tracer-guided method with an air-actuated feed, which is controlled by the pneumatic attachment. Master templet in enlarged form is used with the pantograph. Operator guides tracing stylus over templet to produce drill pattern on work. Ratios of from 1:2 up to 1:12 are possible between work and templet— *New Hermes Engraving Machine Corp, 13-19 University Pl, New York 3, NY*

Forced-feed stock oilers in Stocklube line are designed for short or long runs for metal-forming, stamping, and drawing operations. Circulating pump discharges lubricant through manifold to coat top and bottom of stock. Excess oil is rolled off and recirculated after screening. 5-gal tank and 1-gpm pump are offered on Models R6-4-25 and R12-4-25, which are used with light-bodied oils. For heavy compounds a ¼-hp unit is offered. Stocklube heads are available in two sizes, for maximum of 6- or 12-in. stock widths. Price for unit is $128.

Graymills Corp, 3705 N Lincoln Ave, Chicago 13, Ill

No matter how complex or unusual the work pieces...



Sidney Model 32 Dial-Master Engine or Tool Room Lathe equipped with Sidney Fluid Tracer

the SIDNEY FLUID TRACER HEAD

instantly, precisely and uniformly transfers every change in contour from the master piece or template to the cutting tool. It also controls the hydraulically actuated cross feed and the longitudinal movement of the carriage.

30 OR MORE HYDRAULICALLY CONTROLLED PRE-SELECTIVE SPINDLE SPEEDS

A revolutionary innovation and presented as a "SIDNEY FIRST" as long ago as the Machine Tool Show of 1947 . . . used regularly as a standard SIDNEY feature ever since. But only recently adapted by other lathe manufacturers . . . a fitting tribute to SIDNEY pioneering and leadership.

THE SIDNEY FLUID TRACER can be furnished in connection with any size or model of SIDNEY LATHE. Small runs or quantity production runs show tremendous savings in cost per finished piece. Changeover to standard lathe operation or back to tracer control requires just a few seconds. No addition or removal of parts is necessary because the tracer motor may be turned off while the lathe does standard lathe work.

IT'S "SUPER" IN EVERY WAY

SUPER SWIFT...

SUPER ECONOMICAL...

SUPER SENSITIVE!

Look at what work you can turn with the SIDNEY FLUID TRACER attachment:

Write for new bulletins or ask for representative to call

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

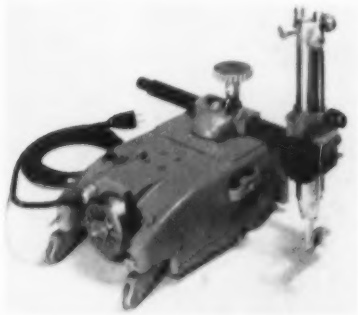
Cutting-Fluid Cooler

Using water as the direct coolant chiller, the Cool-Cut Tool Saver is reportedly capable of maintaining coolant temperatures as low as 45 F, or lower on special applications.

Compressor is of the semi-hermetic type, using Freon-12 refrigerant. Water-cooled condenser is of the shell-and-coil type, with copper-finned tubing. Water tubes are 12-gage steel to assure long life.

Special non-overload feature prevents overloading when unit is subjected to excessively high temperatures and load capacities. Each unit is jacketed with 18-gage steel which is removable in sections for easy servicing. Total down time for cleaning is said to be only 30 min.

Admiral Engineering Co, Inc, 900 W Erie St, Chicago 22, Ill



Linde Metal-Cutting Blowpipe Cuts Eight-Inch Slabs

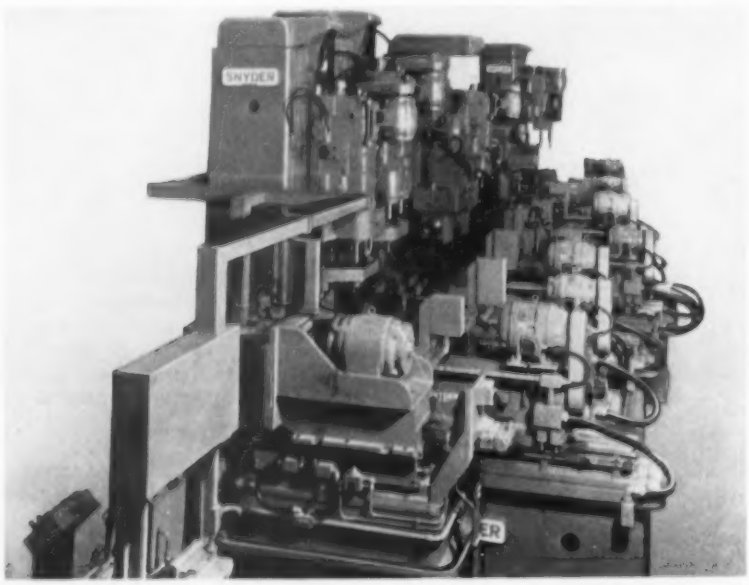
Operating on medium-pressure acetylene or other fuel gases, machine cutting blowpipe is said to be capable of cutting metals ranging in thickness from light-gage sheet to 8-in. slabs. Device is designed for light-to-medium mechanized cutting with Oxweld CM-45 portable machine carriage, but can be used with any machine carriage equipped with suitable blowpipe rigging. Unit is intended for continuous or intermittent straight-line, bevel, or circle-cutting operations.

Cutting-oxygen valve is placed at the front of the blowpipe, providing maximum operating ease by enabling the operator to concentrate on work as he starts the cut. Placement also eliminates the possibility of disturbing preheat valve adjustments.

Rotary-motion cutting-oxygen valve furnishes fast, smooth valve operation without the blowpipe jarring that can occur when cuts are started. Plastic valve packing gives positive, gas-tight seal.

Cartridge-type mixer is designed to give flashback-resistant mixing, and can be removed for repairs without disturbing blowpipe alignment. A complete selection of cutting nozzles is available for use with oxy-acetylene, oxy-propane, and oxy-methane fuels.

Linde Air Products Co, Div of Union Carbide and Carbon Corp, 30 E 42nd St, New York 17, NY



CAST-IRON OILPUMP BODIES for automobiles are machined, washed, and air-tested by 100-ft-long, 84-station segmented transfer machine, which produces 103 pieces per hour at 75% efficiency. Machine features a special parts-distribution system that feeds finish-machined and tested parts to each of three conventional precision boring machines. Machining operations performed include drilling, milling, reaming, tapping, trepanning, boring, spotfacing, countersinking, and chamfering. Entire unit is electrically operated and hydraulically controlled—*Snyder Tool & Engineering Co, 3400 E Lafayette Ave, Detroit 7, Mich*

Blind Rivet Setting Gun Operates With Standard Drill

Designed for operation with a standard ¼-in. electric or pneumatic drill, blind rivet setting gun will set all lengths and all diameters of aluminum, steel, and monel rivets.

Blind rivets are set by a pulling action which is provided as the rotating drill attached to the gun turns a nut case on a movable screw shaft which actuates the pulling-head drawbolt. Shaft and drawbolt automatically return to starting position after each rivet is installed.

To operate the gun, the shaft is inserted in the ¼-in. chuck of the drill motor. Gun is held in one hand and drill in the other, and the pulling head is slipped onto the rivet stem. Drill motor is started and the gun pushed against rivet head in line with rivet stem. Pushing action engages clutch faces and sets the rivet.

Weight without drill motor is 3¼ lb. Length of gun including pulling head but without motor is 14½ in.

Townsend Co, Cherry Rivet Div, Santa Ana, Calif

Today's Most Profitable Grinder for Toolrooms!

most versatile · most flexible · most economical

You can really step up economy in toolroom grinding with the Brown & Sharpe No. 13 Universal and Tool Grinding Machine! Most versatile high precision grinder on the market. Easiest to set up and operate. Assures highest productivity on the widest range of grinding operations. Outstanding features: *Wheel Spindle* has convenient "eye level" vertical adjustment, easy transverse adjustments, quick horizontal angular settings. *Headstock* allows precise angular settings in the horizontal plane. *Table* is swivel-mounted with setting by scale to 90° each side of zero. Broad selection of work, wheel, and table speeds. Plenty of power with no sacrifice of control sensitivity. Available with a wide variety of attachments to further broaden grinding applications. Write for full details. Brown & Sharpe Mfg. Co., Providence, R. I.

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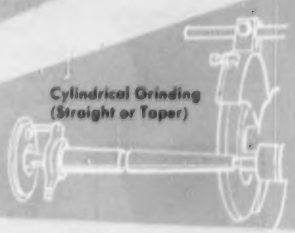
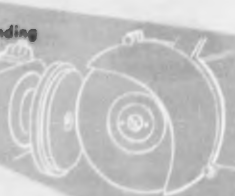
Ask About Our
Pay-As-You Depreciate
Machine Tool Plan

Internal Grinding



Cylindrical Grinding
(Straight or Taper)



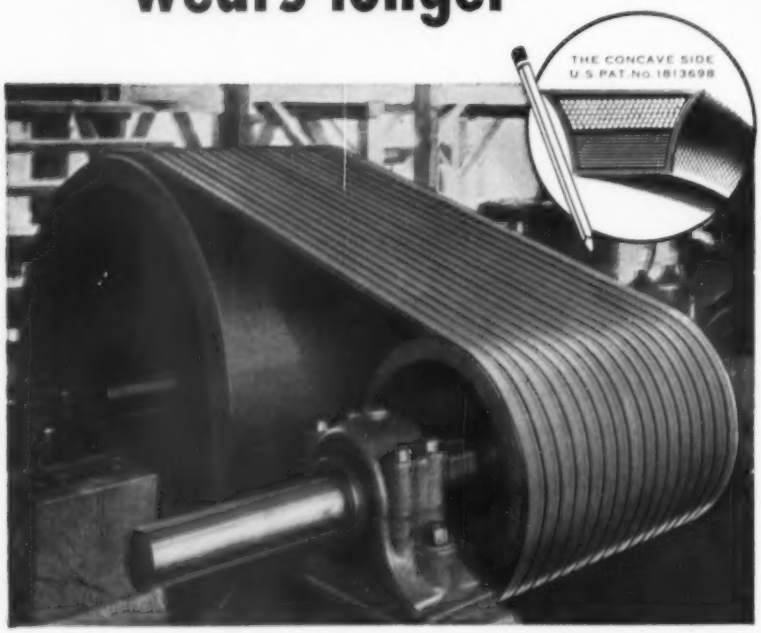
Face Grinding

Surface Grinding

Radius Cutter Grinding

Circular Form Tool Grinding

Why a V-Belt with CONCAVE SIDES wears longer



It is easy to demonstrate to yourself why the concave sides (Fig. 1) of the Gates belt greatly lengthen belt life.

Simply bend a Gates belt and feel the sides. Notice how these precisely engineered concave sides *fill out* on the bend and *become straight*. Thus a Gates belt grips the sheave groove evenly (Fig. 1-A) and wear is distributed uniformly across each side of the belt. That means longer belt life; lower costs.

Make the same test with a straight-sided belt (Fig. 2) and see what happens. The sides bulge out on the bend (Fig. 2-A) concentrating the wear at points shown by arrows.

To assure longer wear and keep belt costs down, specify the V-belt with Concave sides—Gates Vulco Rope . . . readily available from nearby distributor stocks. The Gates Rubber Company, Denver, Colorado—*World's Largest Maker of V-Belts.*

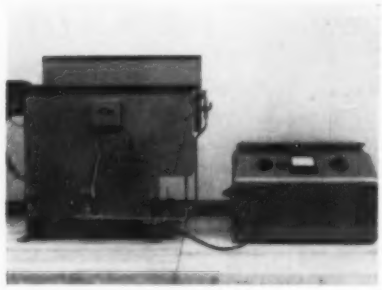
Gates

There are Gates Engineering Offices and Distributor Stocks in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 90

Gates VULCO ROPE Drives

NEW SHOP EQUIPMENT



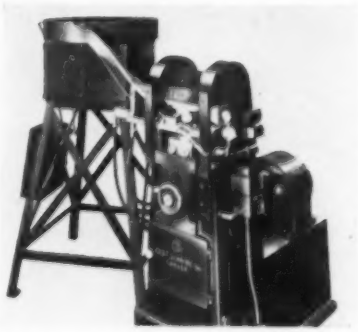
Curtiss-Wright Degreasers Provide Ultrasonic Cleaning

Designed for cleaning fabricated parts in preparation for finishing or assembly, ultrasonic degreaser is 24 x 10 x 18 in. deep and can accommodate work of 8 x 8 x 10-in. size. Two cleaning stages, vapor degreasing and ultrasonic solvent cleaning, are featured, usable in the order desired. Solvents such as trichlorethylene can be used.

Built-in components consist of pump, filter, solvent spray, heater, thermostats, and vapor condenser. Unit is available in stainless- or zinc-clad steel or solid stainless.

Ultrasonic transducer may be moved in its compartment and may be easily removed. Ultrasonic power up to 500 w at 40-kc frequency is available over an area of 7 x 9 in. Generator is housed in a separate unit. Entire equipment operates from 110v, 60c power line, and consumes approximately 2500 w maximum.

Curtiss-Wright Corp. Wood-Ridge, NJ



CORRECTION—The Geo T Schmidt Co end-cap marking machine described in a previous issue (AM—Jun 18 '56, p172) was inadvertently accompanied by a photograph of another machine. A picture of the correct machine is reproduced above. The marker, Model 175-30T, stamps 1600 end caps per hour.

(Continued on page 196)

Surface Grinding

Announcing the
NEW WELDON CATALOG NO. 11

Size 8½" x 11"

A Unique Improved Idea In A Tool Catalog That Makes Selecting Tools Simple, Easy and Confusion-Free . . .

Contains a Complete Listing of

WELDON END MILLS
END MILL HOLDERS
TU-LIP COUNTERBORES
NEW TYPE COUNTERSINKS and DEBURRING TOOLS
ANGULAR CUTTERS
SHARPENING FIXTURES
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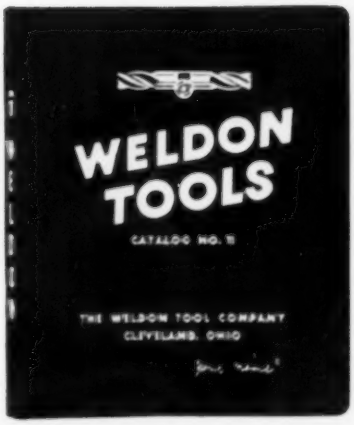
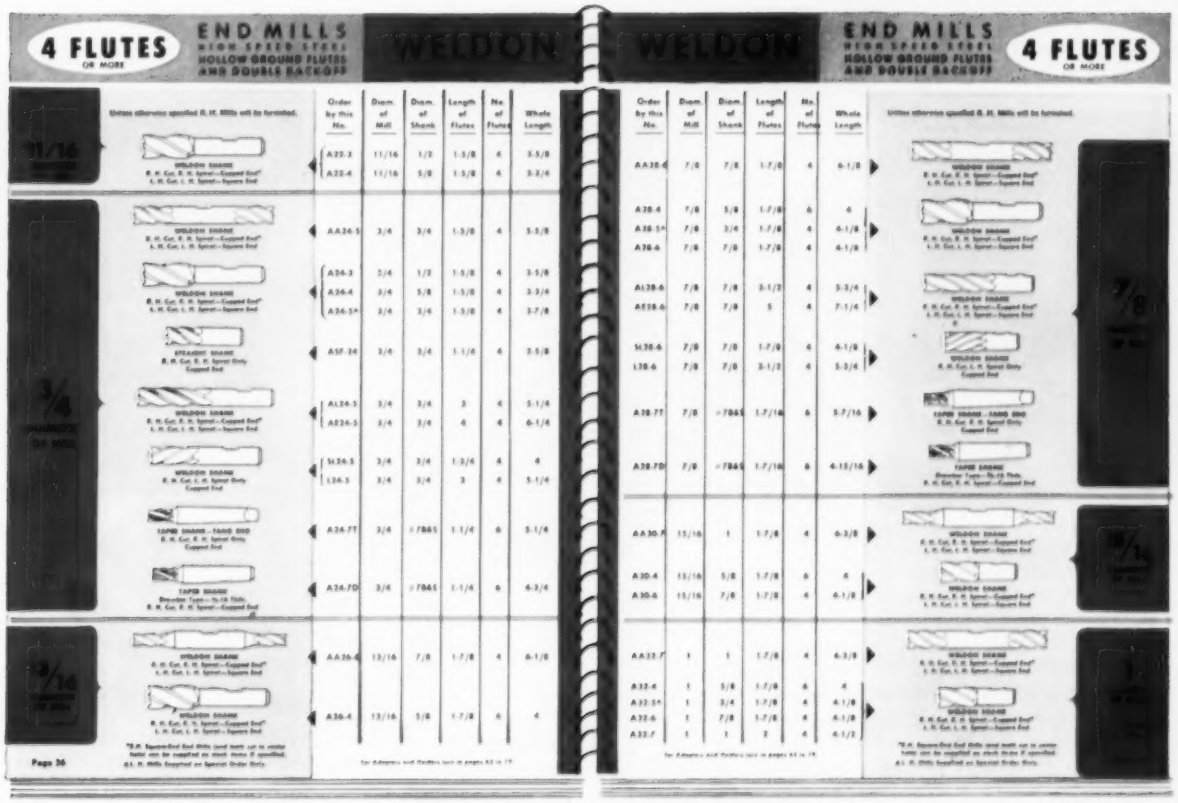
✲ You can PERSONALIZE your catalog with your name in gold (Foil furnished).





A unique new idea in a tool catalog is presented by the Weldon Tool Company, the oldest and largest producer of modern type End Mills, End Mill Holders and Allied Products. The distinct feature of Catalog No. 11 is the progressive listing of tools by sizes, complete with detailed dimensions—an arrangement that will be instantly recognized as a helpful, easy and simple aid in selecting tools with a minimum of confusion.

If you have not already received Catalog No. 11, please contact your Weldon Distributor. If you prefer, write us for a copy, sending your name and company address.

THE WELDON TOOL COMPANY

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YESTERDAY'S PIONEER —TODAY'S LEADER

MUELLER BRASS CO. improves LENSOMETER lower cost

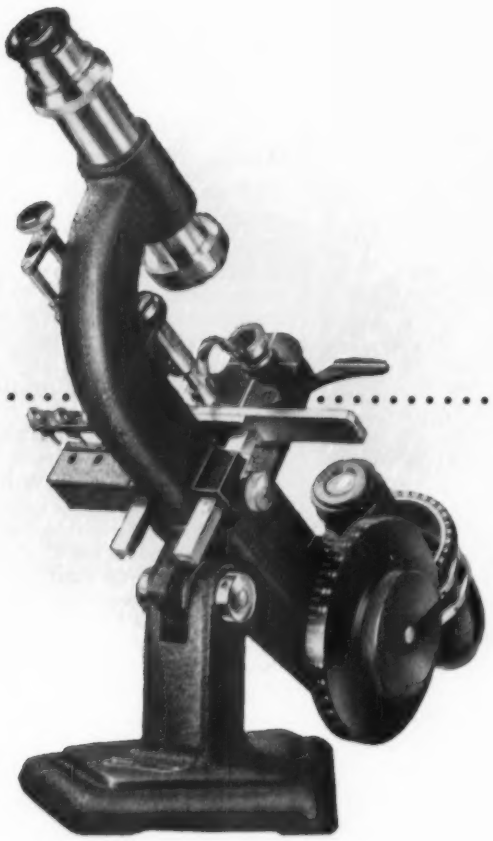
FORGED PART APPROXIMATELY ½ SIZE

Precision and extreme accuracy are vitally important functions of the Lensometer, manufactured by the Instrument Division of the American Optical Company, Buffalo, N. Y. The Lensometer is used to determine the focal strength and axis of an optical lens and, consequently, must be extremely precise in operation to provide accuracy and uniformity in lens prescriptions.

Forgings made by the Mueller Brass Co. play an important role in the construction of the Lensometer and contribute to its outstanding performance. Formerly, the body of the Lensometer was produced from *three* sand castings, but these now have been replaced by just *two* forgings. Naturally, this simplifies assembly, and the big forged bronze main support arm, shown above, along with the lens support bracket insures the constantly accurate alignment of the instrument. During the first year when forgings were used instead of castings, American Optical not only recovered the initial tooling costs but also realized considerable savings on each Lensometer produced. This is another good example of the way Mueller Brass Co. forgings can benefit a product two ways . . . better performance and lower costs. Chances are, your product can likewise be improved at a savings to you if you specify brass, bronze or aluminum forgings made by the Mueller Brass Co.

FORGING

at substantially



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Mueller Brass Co. Forgings
Engineering Manual H-58565 ☐

Tuf-Stuf Aluminum Bronze Alloys
Engineering Manual H-58563 ☐

600 Series Bearing Alloys
Engineering Manual FM-3000 ☐

Copper Base Alloys in Rod Form
Engineering Manual FM-3010 ☐

METALS AND ALLOYS REVIEW

by FRANK M. LEVY

Vice-President and Director of Research

One of our most interesting series of alloys is the group which we market under the tradename "Tuf-Stuf" . . . a group of aluminum bronze alloys with range and flexibility to meet the most demanding needs. They are high copper base alloys containing from 9% to 13% aluminum and varying amounts of iron, nickel and manganese. Being free of zinc, they are not subject to dezincification. Tuf-Stuf alloys have a low coefficient of friction, good wearing qualities, high tensile strength, high hardness and the ability to withstand heavy pounding. Some of the alloys can be hardened by heat treatment. In the harder grades, these alloys are used for heavy duty service where high compressive loads are encountered and where lubrication may be scant. Present day increases in operating speed of modern machine equipment and the economy of little or no machine "down" time has made Tuf-Stuf popular in the machine tool industry. It is used in a multitude of applications where resistance to wear is important, such as: Drill Jigs, Feed Nuts, Rollers, Cams, Collets, Gibs, Gears, Boring Bar Guides, Lead Screw Nuts and Clutch Shifter Forks. Also, because of their ability to withstand higher stresses and resist season-cracking, these alloys are ideally suited for threaded nuts and bolts and pole-line hardware.

The unusual physical properties of the Tuf-Stuf series have made it particularly useful in the chemical and allied industries. These alloys combine the strength and ductility of medium steel with high resistance to corrosion by many chemicals. Tuf-Stuf alloys will not only resist oxidation at elevated temperatures, but will also retain a greater portion of their strength and hardness at these temperatures than will the copper zinc alloys. These properties make them ideal in the aircraft industry for valve seat inserts, spark plug bushings, valve guides and propeller hub cones.

Tuf-Stuf alloys are supplied as forgings, rod or screw machine products. As forgings the grain structure can be controlled to produce parts that are strongest at points of greatest stress and strain. Relatively intricate shapes can be forged to closer tolerances than sand castings. Where appearance is a factor, a forging may easily prove more economical since a minimum amount of machining, buffing or polishing is required before finishing.

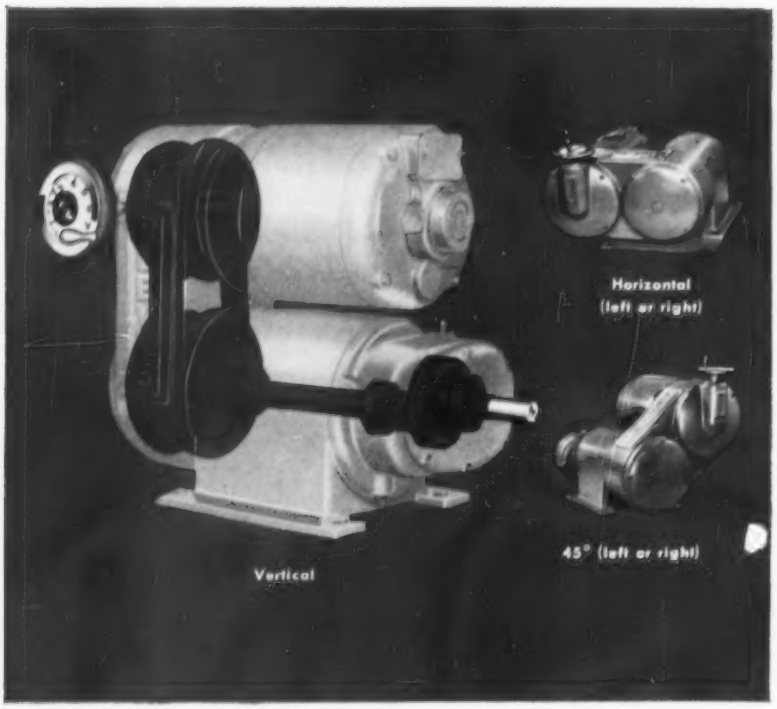
If you'd like more information about this series of alloys, drop me a line or better yet, send me your sample part or blueprint and an explanation of its use and we'll be glad to submit our recommendations.

MUELLER BRASS CO.

PORT HURON MICHIGAN

178

A Compact Model to Fit Wherever You Need Variable Speed

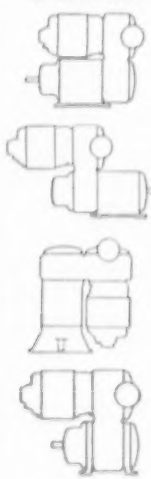


REEVES

FRACTIONAL *Vari-Speed* MOTODRIVE

WHERE DO YOU NEED THE OUTPUT SHAFT?

Motor side, control side, or vertical down



▶ REEVES fractional hp. Motodrive is a complete power package, engineered in over 100 assemblies, providing the advantages of variable speed to your machines—in minimum space.

Choose from vertical, 45° or horizontal models in ¼ to 1 hp. . . . get stepless accurate speeds—within a 2:1 to 10:1 range—from as low as 3 rpm to a maximum of 4660 rpm.

Available in standard, weather resistant, totally enclosed or splash-proof enclosures; full range of manual or automatic controls.

REEVES Motodrive—The *right* speed for *every* need . . . in *any* place.

Write Dept. A23—M543 for ratings and dimensions

REEVES DIVISION • COLUMBUS, INDIANA

RELIANCE ELECTRIC AND ENGINEERING CO.

Industrial Tractor Requires No Operator

Guide-O-Matic is designation for electronic tractor which can pull up to 6000 lb of freight. Working in an undeviating path, tractor requires no operator. Embedded just beneath the surface of plant floor is a guide wire that emits an electronic signal which is sensed by a receiver on the tractor. Electronic system guides tractor left or right and controls starting and stopping. It may also consist of a wire under a tape laid on the floor, or a wire strung overhead.

There is no physical contact between wire and tractor. Signals picked up by receiver mounted on tractor control all movements.

Tractor has a top speed of more than six miles per hour, and is equipped with hand controls for conventional battery-powered use when desired.

Barrett-Cravens Co, 628 Dundee Rd, Northbrook, Ill

Continuous-Duty Power Unit Operates on LP Gas

Ready-Power model H-3, designed for use on 2000-to-5000-lb sit-down

Pour savings into your shop with

GULFCUT

cutting oils

Gulfcut is the new brand name for Gulf's complete line of modern, up-to-date cutting fluids. Each Gulfcut oil is scientifically compounded to meet the most exacting requirements for tool life, accuracy of work, and surface finish.

This new line of Gulfcut oils includes mineral-lard oils, sulfurized-mineral oils, sulfurized-mineral lard oils, sulfochlorinated-lard oils, and emulsifying oils—outstanding cutting oils that contribute to better results in every metal cutting operation.

Have a Gulf Sales Engineer show you how one or more of the Gulfcut line of cutting oils can help you get increased tool life and lower machining costs in your shop. Consult the telephone directory for the number of your local Gulf office.

Gulf Oil Corporation • Gulf Refining Company
1822 Gulf Building, Pittsburgh 30, Pa.

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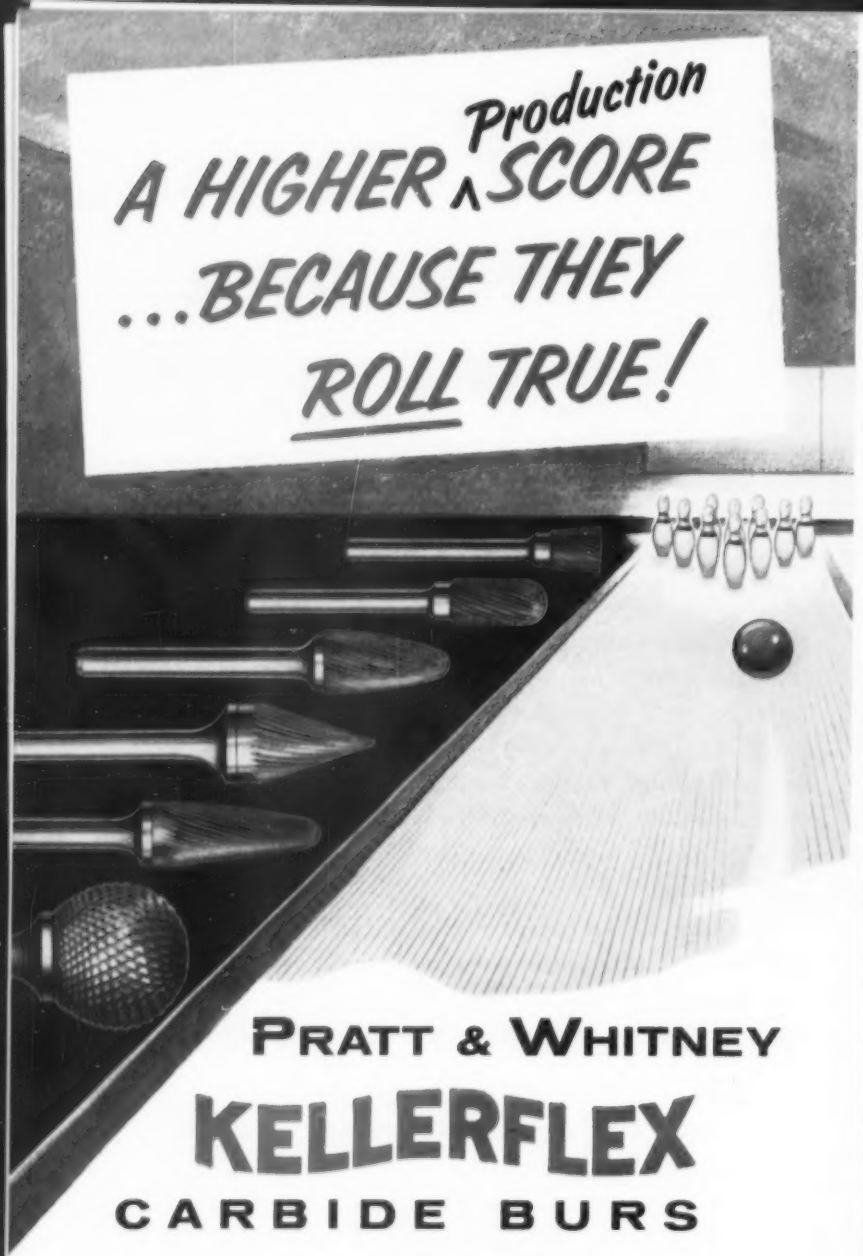
FOR ALL YOUR NEEDS



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KELLERFLEX

CARBIDE BURS

If you're looking for carbide burs that roll smoothly in the work . . . that cut faster and eliminate fracture-producing chatter and bounce . . . you'll find that P&W "Master Machine Ground" Carbide Burs are right down your alley! Exclusive machine grinding insures a concentricity and overall precision that *no* hand-ground bur can possibly match. That's why P&W Kellerflex Carbide Burs can help you roll up higher production scores.

YOU'LL FIND COMPLETE INFORMATION . . . on P&W Carbide Burs in Circular No. 564 . . . and you'll find that there are sizes, shapes and fluting types for every job requirement in the complete P&W Bur line. Send now for your free copy.

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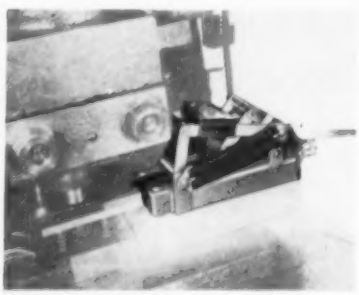
MACHINE TOOLS • GAGES • CUTTING TOOLS

NEW SHOP EQUIPMENT

electric trucks, is a continuous-duty power unit which operates on LP gas. Special mounting on top of unit accepts 33½-lb or 43½-lb standard LP-gas fuel tanks or ASME-type tanks.

Hinged cover and side plate allows easy access to engine accessories needing periodic attention, without removing fuel tank. Removable end plate gives quick access to generator and instrument panel.

Ready-Power Co, 3826 Grand River Ave, Detroit 8, Mich

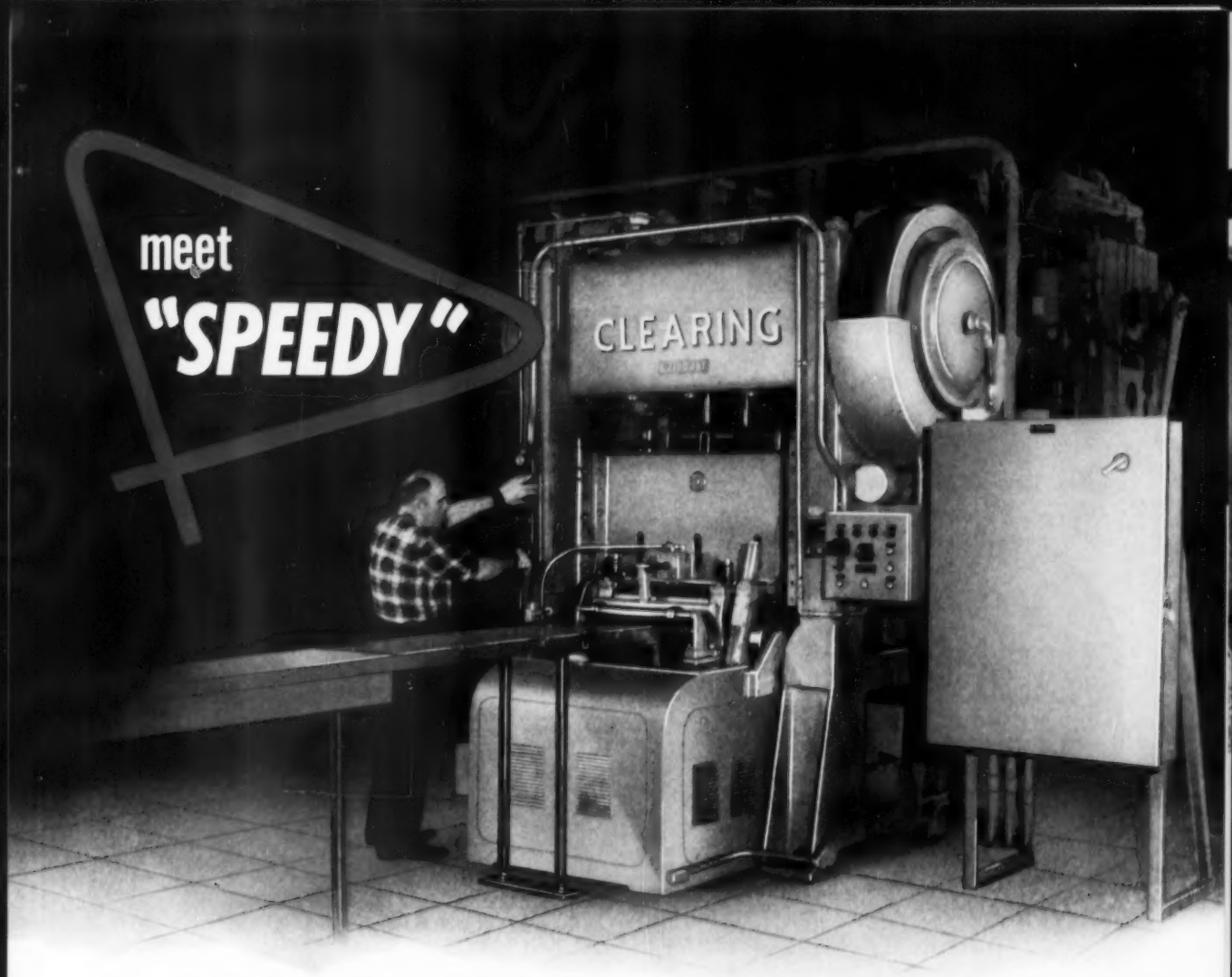


STOCK FEEDS called Jaco-Matic are made in three models to handle coiled stock in a range of widths in infinite increments up to 4 in., thicknesses up to 3/32 in., and feed-stroke lengths up to 4 in. Micrometer adjustment allows feed stroke to be set to an accuracy of 0.001 in. Feeds will advance stock on either the up or down stroke of press ram, and will handle any kind of coiled stock. Ranging in weight from 8 to 12 lb, units can be mounted on the dieset or press table of any type of mechanical, hydraulic, compressed-air, or electrically operated press—*Jaco Devices, Inc, 90 High St, Hingham, Mass*

Air-Operated Quench Tank

Unit consists of one tank within the other; outer is higher and larger in

(Continued on page 202)

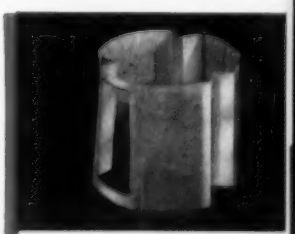


the *CLEARING ROBOT* that's setting records at HOTPOINT

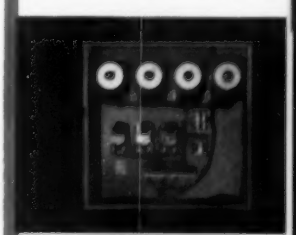
Here's a Clearing high speed press that's making steel confetti fly at Hotpoint's Home Laundry plant in Chicago. Each piecepart has 5,000 perforations which are grouped in three different locations. The press operates at a speed range of 125 to 250 strokes per minute and "thinks" for itself in the matter of locating the hole groupings and the number of holes which is correct for each grouping.

The result is a finished part from which the cylinder of a dryer basket is made. It's a result that gives Hotpoint accurate parts, produced economically with a minimum of material handling.

If there is a place for one of "Speedy's" energetic and thoughtful brothers in your manufacturing plans, call on a Clearing sales engineer to talk the problem over.



Hotpoint dryer basket after it has been perforated and rolled into its cylindrical shape.



Part of the electronic brain that tells "Speedy" when to start and stop and where to locate the perforations.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

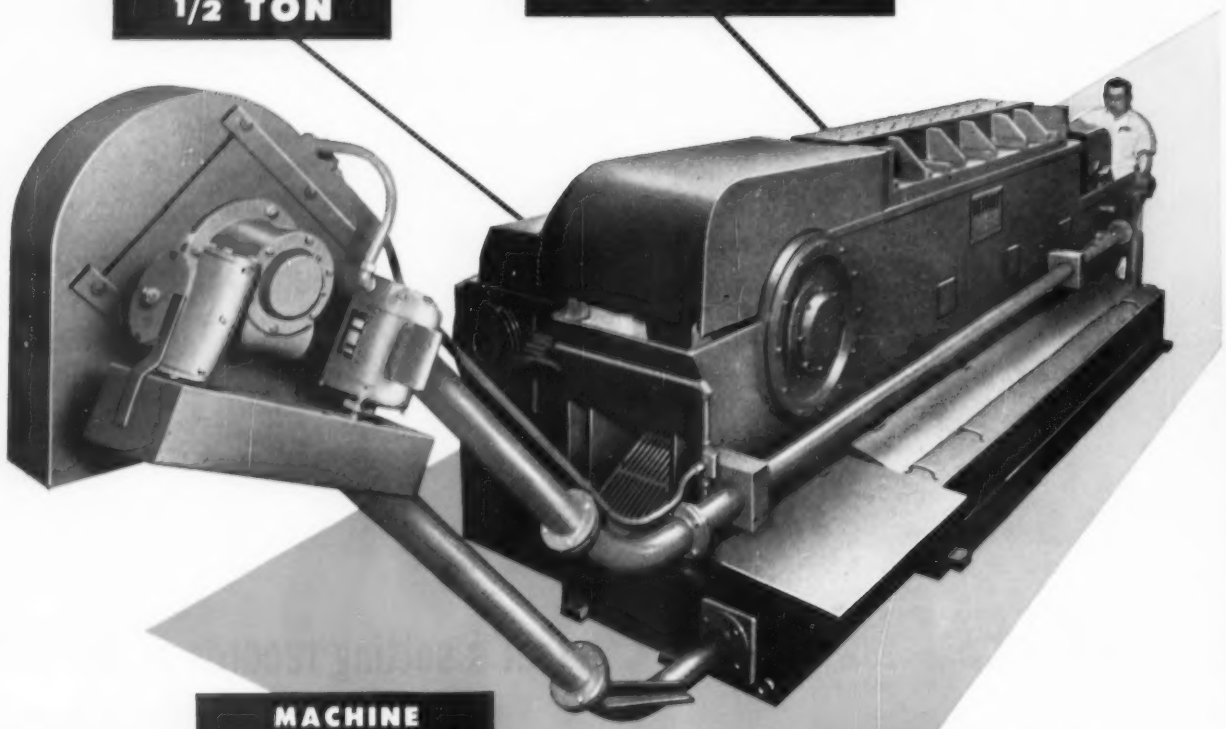
CLEARING MACHINE CORPORATION • *Division of U.S. INDUSTRIES, INC.*

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Plant, Hamilton, Ohio

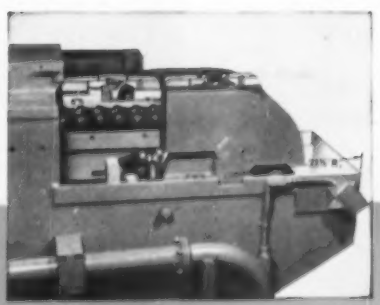
NEW DETROIT Continuous

BULL GEAR
1/2 TON

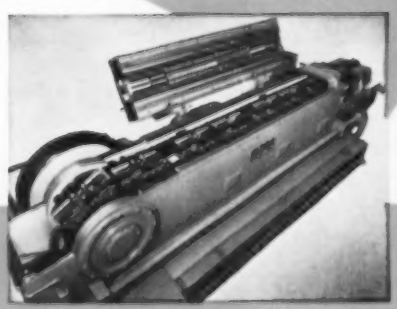
BROACH TUNNEL
13/4 TONS



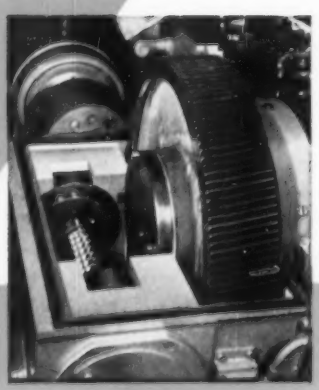
MACHINE
171/2 TONS



Note generous radius from chain axis to outer machine frame, 22½" at loading end, 23½" at unloading end. This assures easy, safe handling of wide variety of work sizes and shapes.



Broach tunnel raised to show heavy duty twin chain type drive and automatic hammer lock fixtures. Tunnel and broaches weigh 3,750 lbs., while entire machine weighs 35,000 lbs.



Massive ½ ton bull gear provides positive pulling power and smooth operation required for extremely fine finishes. Gear is directly connected to main drive drum.

locate the perforations.

BROACH
Horizontal Machine

WEIGHT *where you want it!*

ROOM *where you need it!*

Extreme weight and rigidity are the answers to high-production surface broaching with fine work finishes and long tool life . . . and this husky new Detroit Continuous Horizontal gives you *the most you can get!*

PLUS

- Generous loading and unloading clearances for easy, safe handling of a wide variety of work.
- All-welded, heavy steel plate frame.
- Fully automatic fixture locking, machine operation and unloading.
- Safety interlock assures proper work positioning before operation.
- Heavy-duty, twin chain electric-mechanical drive.
- Simple change gears for varied cutting speeds.
- Entirely self-contained, including automatic chip disposal unit.
- Electric and hydraulic equipment to J.I.C. standards.

Model illustrated is 90" stroke 15-ton capacity with cutting speeds to 40 f.p.m. Other 15-ton models available with 66" and 120" stroke, lower and higher tonnage capacities on request. Send part prints for prompt recommendation and quotation, or mail coupon now for free descriptive literature.

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Universal Winding Co. Cuts Tool Costs With McCaskey Tool Crib Control

Since installing McCaskey Tool Controls, the Universal Winding Company of Cranston, R.I. reports a big improvement in shop efficiency and major reductions in operating costs.

Mr. J. W. Egan, Tool Supervisor, says McCaskey Methods have been used since 1952 in the two main tool cribs for both their textile twisting and winding machines and for their electrical coil winding machines. He high-spots the benefits:

"McCaskey Tool Crib Control has not only tied responsibility for specific tools to each employee but has enabled us to get a monthly report on worn and damaged tools which are charged to each department. Also, tool crib operation has been speeded up now that the location of all tools on the floor can be readily determined."

Mr. Egan adds: "By disclosing dead and infrequently used tools, as well as any excessive inventory of active items, McCaskey has enabled us to cut our overall tool inventory and save considerable money."

Comparable operating savings can easily be yours. McCaskey has Tool and Gage Controls and specific control systems to offer money-saving benefits regardless of your products, or the size of your plant.

Find out how McCaskey eliminates such costly operating expenses as tool loss and theft, high breakage, unbalanced inventories, and production delays. Mail coupon today for free booklet. No obligation, of course.

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Chicago 18, Illinois

Please send me your new booklet: "How Tool Costs Were Cut 12 Ways in 20 Plants."

Name

Position

Company

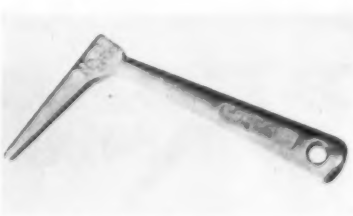
Address

diameter. Area between serves as overflow space for water on the water quench tank and for storage and cooling on the oil tank.

Work basket, located on the center air cylinder, can be rotated. Foot valve can be used to oscillate the basket up and down or raise it completely out of solution. Tanks do not require pit settings or special installation. Semi-mobile, they can be incorporated into other operations in plant areas with minimum of wiring and piping.

Waltz Furnace Co, Dept 1, Symmes St, Cincinnati, Ohio

BATTERY-OPERATED VIBRATION METER, Type 1-128, uses two ordinary 22½-v dry batteries to provide power. All-transistor unit can be carried and used anywhere to measure the amplitude of vibrations in the 10-to-1000-cps frequency range. Four junction transistors make up the entire "valve" complements, eliminate the warmup time required by vacuum tubes. Pick-ups are used to sense vibration, which is indicated directly on a dial as mils peak-to-peak displacement. Bulletin CEC-1566 — *Consolidated Electrodynamics Corp, 300 N Sierra Madre Villa, Pasadena, Calif*



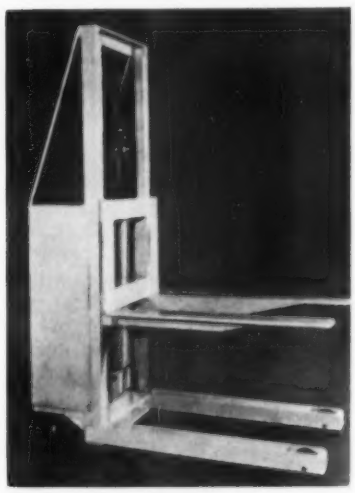
Scully-Drift Tool Ejector

Unit designed to eliminate damage to machine spindles and bearings caused by hammering can be used with one

hand, allowing operator to maintain control of tool with the other hand.

Cam-type ejector is inserted in drift slot at any angle. Twist of the wrist generates force against the tang of the tool, pushing it out of the spindle. Units are available in sizes for No. 2 and 3 Morse taper spindles.

Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill



Hydraulic Skid-Lift Truck Handles 5000-lb Loads

Portable skid-fork truck is designed to bring material to work heights up to 52 in. Fork length is 56 in., with width of span of 24 in. Maximum load capacity is 5000 lb.

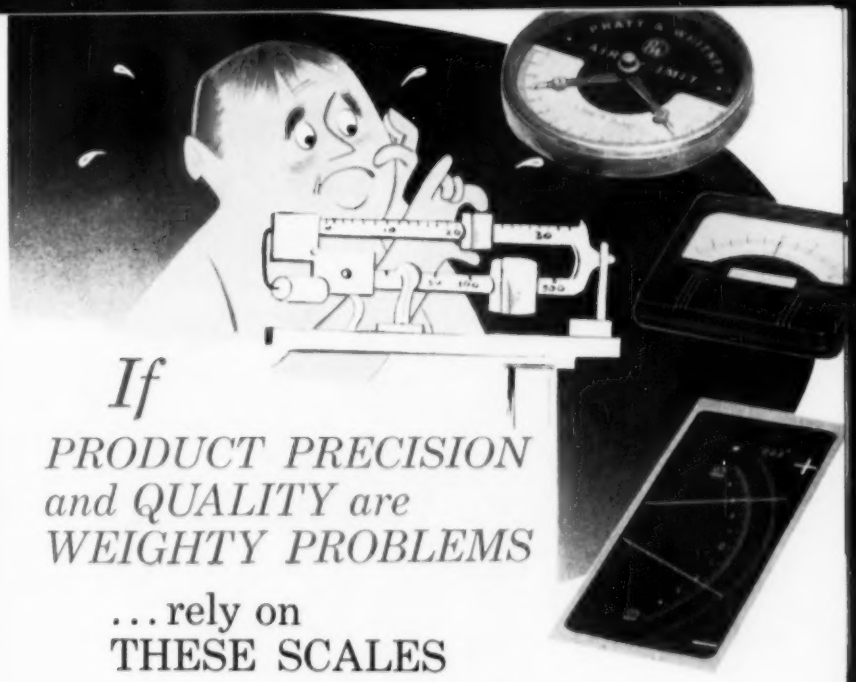
Electric pushbutton controls lower or hold load in position without power. Normal rate of lowering or raising is 1 in. per second, but speed can be regulated by adjusting a control valve.

Drive is powered by single or three-phase ac or 12v battery with built-in charger. Truck is said to be easily adaptable for operation by remote control. Casters and wheels have been placed under the frame, so that truck can pass through aisles only slightly wider than 24 in.

Hydro-Lift Co, 3825 N Ashland Ave, Chicago 13, Ill

Hand tapping tool called Tri-Tap cleans or cuts any of three common thread sizes in electrical boxes and fixtures without changing taps. Device contains the three most popular size taps—6/32, 8/32, and 10/32 in. Handle is plastic, taps are of Jamison K-47 drill rod.

Hunter Tool, Box 564, Whittier, Calif



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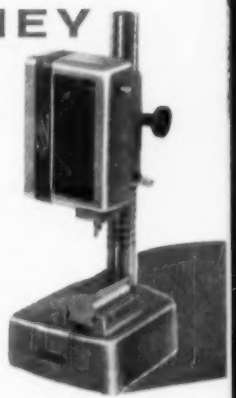

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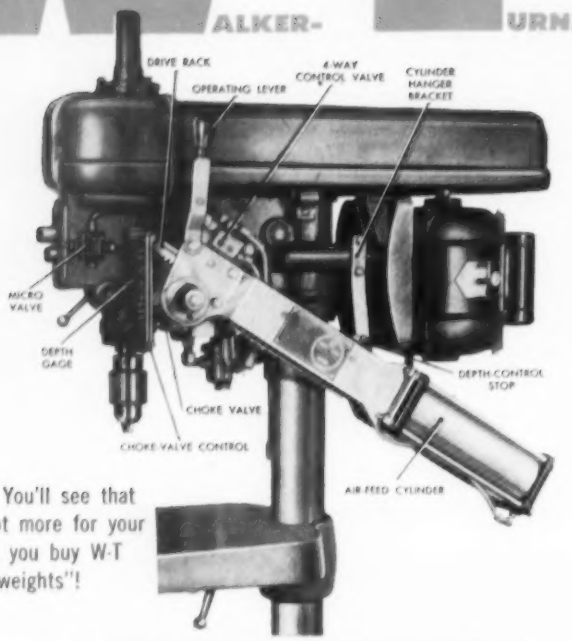

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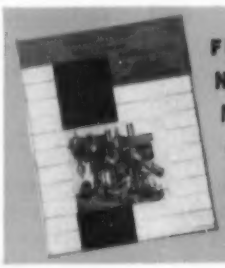

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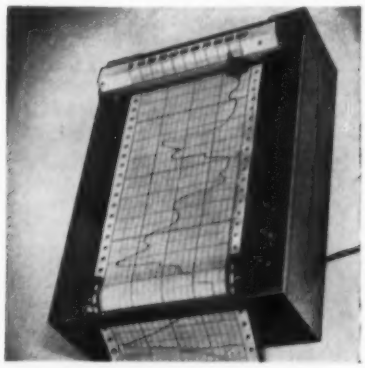

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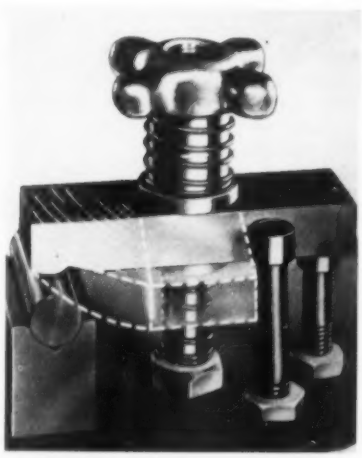
Portable, low-cost strip chart recorder operates on self-balancing potentiometer principle. With appropriate sensing devices it will record temperature, speed, light pressures, resistance, motion, or any variable that can be represented by a dc millivolt signal within its range.

Design features include rectilinear tracings; 100-mv full scale, high input impedance; vertical or horizontal ink writing; servo motor; 5-in. pen travel; sprocket-driven chart; table or wall mounting. Instrument is 6 in. high, 9½ in. wide, 14 in. long, weighs 15 lb. Price, $291 FOB.

C H Stoelting Co, 424 N Homan Ave, Chicago 24, Ill



SWINGLOCK FIXTURE CLAMP, adjusted with one hand, opens or locks with quarter turn of a knob. Operates in restricted areas and in any position without strap falling out of place. Furnished with ¼, 5/16, ⅜, ½, ⅝, ¾, or 3/16-in. studs—*West Point Manufacturing Co, 26935 W Seven Mile Rd, Detroit 19, Mich*

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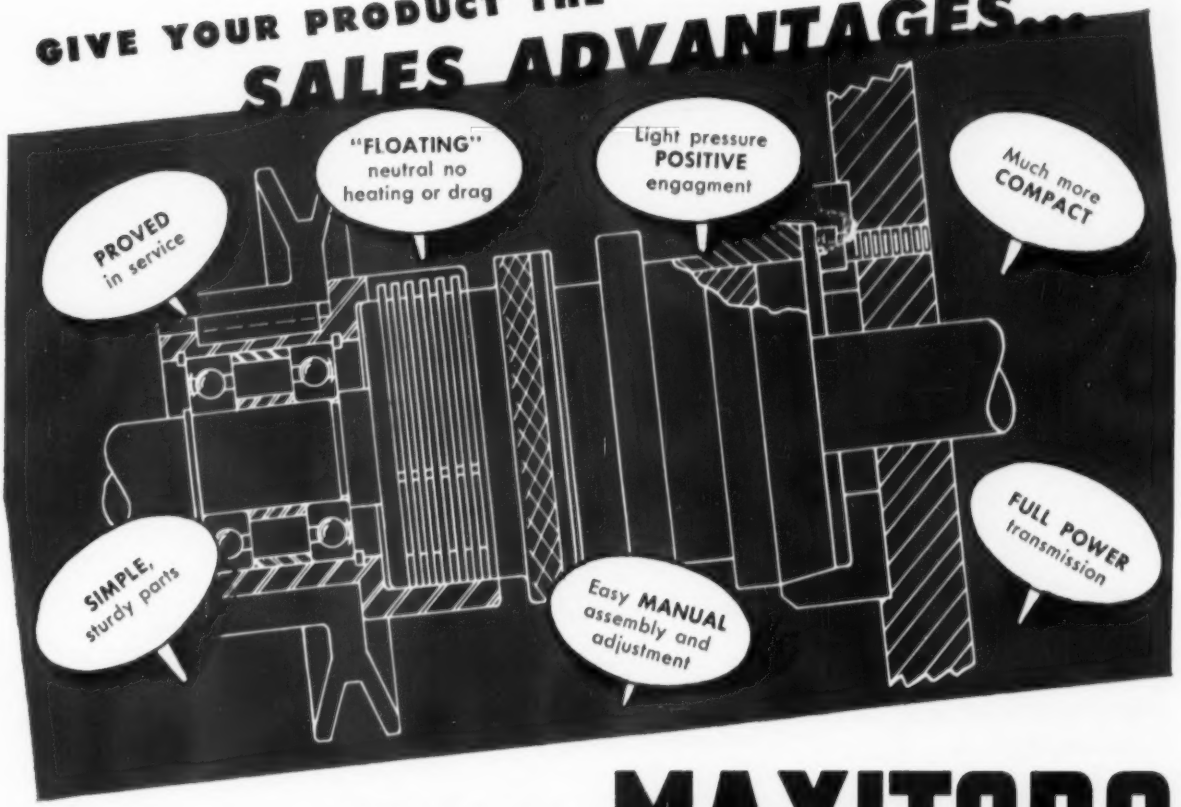

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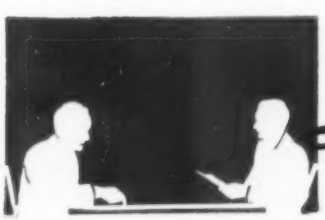
The above line drawing illustrates a single MAXITORQ Clutch arranged for single V-belt drive with a special sliding beveled shifter sleeve acting as a light brake.

Yes, there are many types of MAXITORQ . . . single, double, overload release . . . to meet every installation need. Get our comprehensive technical data . . . let our engineering department help you work out special drive problems. Write or phone: Dept. AM-7, The Carlyle Johnson Machine Company, Manchester, Conn.



Let's talk MAXITORQ

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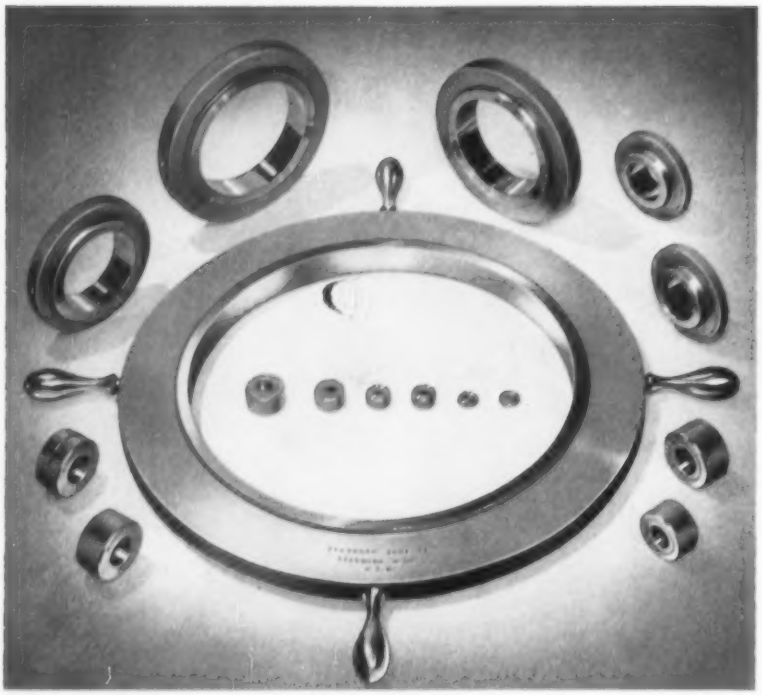

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Scully-Jones Drill Stops Provide Precise Depth Control

Line of drill stops for the positive control of hole depth has been improved by the addition of a calibrated locknut and a reference line on the threaded body of the tool. To adjust depth, operator loosens setscrew in the quick-lock nut, turns nut on the threaded shank to the desired position, and then tightens the setscrew.

Chip windows are provided for preventing the packing of chips around the tool, together with chip

"The right quench oil for our work is

SHELL VOLUTA OIL 23"

says Garland Wilcox, Chief Metallurgist
Wallace Barnes Co., Bristol, Conn.

...the story of a profitable change

WALLACE BARNES COMPANY and steel springs have "gone together" for nearly a century. Most of today's output is in SAE 1075 or 1095 steel.

Because the quenching operation is so important to the life of springs, the Wallace Barnes laboratory decided to test its regular quenching oil against some of the newer products, including Shell Voluta Oil 23. This is what they found:

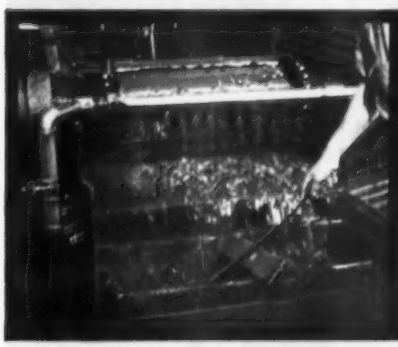
Shell Voluta Oil 23 showed a superior quench rate, with correct hardening and relative freedom from distortion. It drained more rapidly from the quenched parts, reducing dragout loss. It washed off more completely in the alkaline cleaner; it reduced flaming, and cut down on the oil baked to parts.

Wallace Barnes reports that this oil has almost eliminated trouble with "slack-quenched parts," and that heavier stock now goes through without special handling. So . . . Shell Voluta Oil 23 has replaced the former quench oil in all tanks of the spring hardening departments, serving salt pot lines and shaker hearth furnaces.

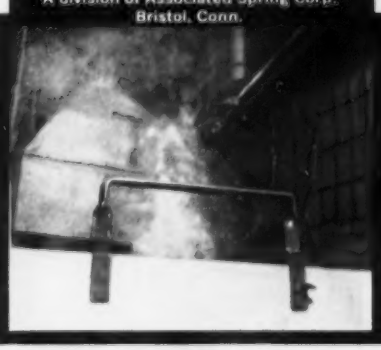
We'll be glad to provide full information on Shell Voluta Oil 23.

WALLACE BARNES CO.
A division of Associated Spring Corp.
Bristol, Conn.

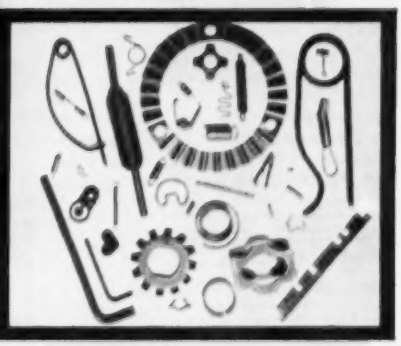
Photos courtesy "STEEL"



Shaker hearth furnaces automatically dump parts into Shell Voluta Oil 23, then remove and drain them.



Flat springs at austenitizing temperature get a fast quench in Shell Voluta Oil 23.



Over 35,000 prints of production items like these are kept on file at Wallace Barnes Co.

SHELL OIL COMPANY

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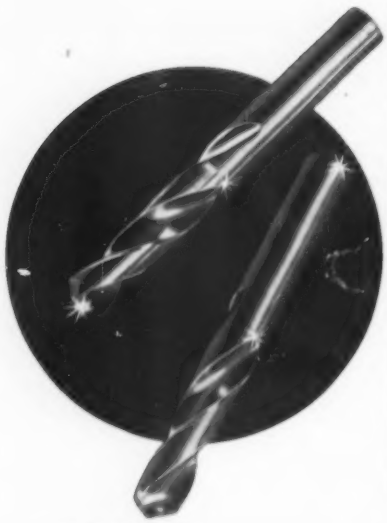
SHELL



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ACE DRILL CORPORATION
Adrian, Michigan

Gentlemen: Please send me your Catalog No. 52-A containing complete information on ACE "Ground-from-the-Solid" Drills and hardened H.S.S. drill blanks.

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ADRIAN, MICHIGAN
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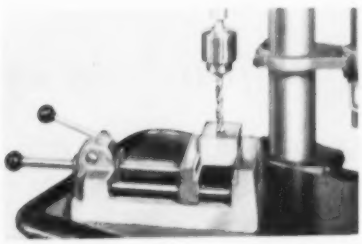
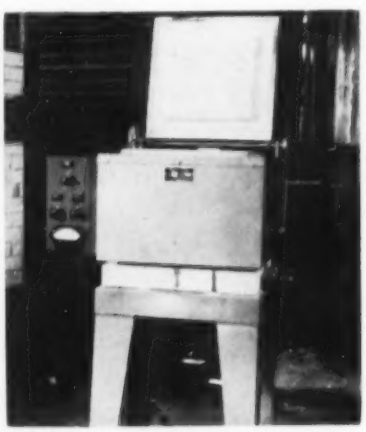
wiping grooves in the stopping face. Tools have been designed with small-body diameter to permit operation on close centers and near shoulders or obstructions. Nose of the adjusting sleeve, or stop collar, is square with its inside diameter for accuracy.

Standard tools are available in eight sizes to accommodate drills up to 1½-in. diameter.

Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill



VISE AND FIXTURE BASE, Gripmaster Model TS, is offered in two sizes with 3- or 4-in. jaw widths. Choice is offered of either the standard SV locking mechanism for general work, or the PA series locking mechanism which enables operator to advance jaw forward by "pumping" the locking lever. Jaw sides are precision ground at right angles to parallels for accurate work —*Heinrich Tools, Inc, Racine, Wis*



Dewaxing and Firing Furnace Handles Glass Molds

L & L Model 1213-V combination dewaxing and firing furnace was developed for use in Corning Glass Works' Glascast molding process (*AM*—Jun 4 '56, p170). Unit, a modified top-loading firing kiln capable of 2200 F temperatures, dewaxes and fires Glascast molds in one 10-15 min operation. Wax recovery from

machines last longer...

Priced from 190.00

wear reduced as much as **80%** with easy-to-move

TORIT DUST COLLECTORS

Dust causes wear, damages bearings, bedways, slides and saddles and other "sensitive" machine parts. Clean machines hold close tolerances better and need re-grinding or alignment only ⅛ as often. In five years, users of Torit dust collectors save up to $1,600 in re-grinding the ways of the average grinder—and save hundreds of dollars *more* in down-time.

MANY COMPACT MODELS . . . all self-contained. Unitized for custom installation. More economical, usually more efficient than central (built-into-the-building) systems. For more information, write today to . . .

TORIT
MANUFACTURING COMPANY

Sweet's

Dept.
311 Walnut Street,
St. Paul 2, Minn.

Sighted scale—scoured same

PHOTOGRAPHED AT DETREX CORP., DETROIT, MICH.

For outstanding performance in scale removal, at highest rates and lowest cost, nothing matches pressure blasting with BLASTITE® Abrasive Grain by CARBORUNDUM. BLASTITE® Grain is fused aluminum oxide... the individual particles are sharp, angular and inherently *tough*. They do not break down readily—may be reclaimed and reused many times with finest results. BLASTITE® Grain offers many other economies, too. It leaves no powdery residue for cleanup after blasting. It is not affected by moisture—will not pack in air lines and connections. And pre-paint surfaces prepared with BLASTITE® Grain require fewer prime coats than surfaces blasted with other materials. You may not fully realize how versatile the blasting method is—how many ways you can use BLASTITE® Grain with profit. Your CARBORUNDUM Distributor or salesman will be glad to show you. Or write The Carborundum Company, Niagara Falls, New York, and ask for Booklet No. 14. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

Your best first step in giving dull cemented carbide tools a new lease on life is to select a "Green-Grit" silicon carbide wheel by CARBORUNDUM. For milling cutters and other multiple-point tools, where finer finishes are required, "Green-Grit" resinoid bond wheels offer superior form-holding ability. Even with heavier infeeds, they cut free and cool. In roughing operations, where stock removal is more important than finish, you'll find "Green-Grit" vitrified bond wheels your best bet. They permit both steel and carbide to be ground together—with outstanding results.

Your CARBORUNDUM Distributor or salesman can help you choose the right "Green-Grit" wheel for every job. Call him today. For Booklet A-1208 on carbide grinding, write The Carborundum Co., Niagara Falls, N. Y. In Canada: Canadian Carborundum Co., Ltd., Niagara Falls, Ont.

Through application "know-how" and product quality

CARBORUNDUM

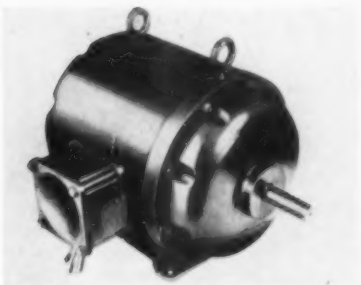
REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

the mold assemblies is said to average 95%.

Furnace has a removable bottom covering a stainless-steel funnel. Wax, melted from the mold assembly, falls through the funnel and is recovered below. Bottom is then replaced and the mold is fired; it is ready for casting when removed from the furnace.

L & L Mfg Co, Upland (Chester), Penna

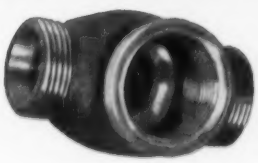


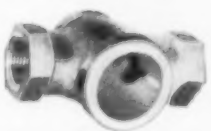
EXPLOSION-PROOF MOTORS are offered in a complete line through NEMA frames 405 and 214. Design meets underwriters' requirements for the three most hazardous locations: gaseous, explosive dust, and explosive grain dust. Motors are specially treated to resist moisture, dust, and corrosive atmospheres, and feature exra-long flame paths at shaft and bracket fits and sealed, pre-lubricated ball bearings. Units are available in standard, geared, or variable-speed models, with optional mountings to meet individual requirments—*Sterling Electric Motors, Inc. 5401 Telegraph Rd, Los Angeles 22, Calif*

Special Lift Truck Handles Large Ingots

Straddle hand-lift truck, designed to accommodate leg clearances under two inches, utilizes hydraulic system and steering mechanism for ease of operation. Built for handling ingots of aluminum, lead, and other

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.





Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.

Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

DO IT BETTER — QUICKER — AT LESS COST

WITH Atrax SOLID CARBIDE

STANDARDS!

Atrax stock tools eliminate the waste & worry of "specials" 99 times out of 100!

All of the standards in the Atrax line were once "specials"—engineered and built to meet specific production demands. When the Atrax requirements of performance and dependability were proved, these tools were stocked as standards at standard prices—and are now available without delay, to meet virtually all metalworking needs. Whenever you're faced with a tough job, consult the Atrax catalog listing over 1000 standard tools before you order a "special". A production-proved tool to do the job—and do it right—is undoubtedly in stock. Always specify Atrax, you can't get a better tool—you can't get better performance.

Eliminate the cost and delay of "specials"—send today for the Atrax catalog illustrating more than 1000 solid carbide tools to do 99% of all metalworking jobs!

Atrax

THE ATRAX COMPANY

Newington 11, Conn.

materials, truck can hold a 2500-lb load.

Over-all width of unit is 37½ in, lift is 4 in., and forks are 1½ in. thick. Forks are 30 in. long.

Market Forge Co, 35 Garvey St, Everett 49, Mass

ELECTRONIC GAGE measures taper and OD simultaneously on automobile pistons, then stamps a code letter on piston to identify diameter. Gaging and stamping action on Model 144 B-83 are automatic; parts are manually fed. Cycle is approximately 4½ seconds—*Federal Products Corp, 1144 Eddy St, Providence 1, RI*

Pneumatic shut-off valve, dc solenoid-operated Model 21A, is available in normally open or closed versions with or without manual over-ride. Device has a statically balanced valve and sealing members of stainless steel and teflon or nylon. Two-, three-, and four-way units are available, as well as those with special configurations. Suitable for use with air, nitrogen, and most gases, valves have the following additional features: temperature range, -65 F to +275 F; current drain, 1.5 amp max at 30 v dc; voltage range, 18 to 30 dc continuous duty.

Essig Co, 4063 Radford Ave, North Hollywood, Calif

Miniature self-locking threaded insert is designed for use in materials such as aluminum and magnesium alloys and plastics, where a strong internal thread is required. Known as NAR 4-40L, device is made of non-magnetic stainless steel, can be used for applications up to 550 F. Insert consists of two parts, which are easily installed in a drilled or tapped hole with a screwdriver. It is currently being manufactured to receive and lock a 4-40 screw. Actual size is ¼ in. OD and ¼-in. height.

Newton Insert Co, 1321 E 17th St, Los Angeles 21, Calif

GEARS *that keep* AMERICA *on the* GO!

In vehicles of almost every description—from boats to heavy farm machinery—you'll find flywheel ring gears, transmission gears, differential drive gears, and other gears that are designed, engineered, and manufactured by Automotive Gear Works.

If your product uses gears for power transmission, it may pay you to look into the popularity of gears manufactured by Automotive Gear Works—and learn how we serve as the "gear department" for so many leading manufacturers. Why not write today for further information?

DOUBLE DIAMOND GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

ESTABLISHED IN 1914 RICHMOND, INDIANA

SUBSIDIARY OF EATON MANUFACTURING COMPANY

Another of the Reasons Behind Brad Foote Quality—

TOOTH SPACING

• 99% of gear drawings do not specify tooth spacing. For most applications, industry generally believes that competent gear manufacturers, working by standard AGMA practices, will produce gears within the limitations required for easy assembly and good load transmission.

• Occasionally, however, on very precise jobs you may find it necessary to specify extreme accuracy of tooth spacing and nonadjacent tooth spacing. Applications such as radar mounts, timing mechanisms, indexing mechanisms—all may require closer tooth spacing tolerances than are obtainable with average equipment in the hands of regular gear manufacturers.

• BRAD FOOTE welcomes precision jobs like these. We can add to highly specialized equipment specific experience in meeting this, as well as many other demanding requirements for special gear production.

• Prove to yourselves the savings that BRAD FOOTE quality can mean. Let us quote on the gear requirements for your next program.

BRAD FOOTE MAKES ALL TYPES OF GEARS—
IN A COMPLETE RANGE OF STYLES AND SIZES

BRAD FOOTE GEAR WORKS, INC.

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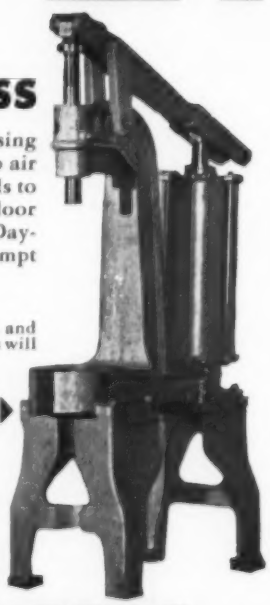
subsidiaries | AMERICAN GEAR & MFG. CO. Lemont, Illinois Phone Lemont 920 | PITTSBURGH GEAR COMPANY Phone SPalding 1-4800 Pittsburgh 25, Penn.

SAVE!

WITH A HANNIFIN AIR PRESS

It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.



WRITE. Complete information and prices on Hannifin Air Presses will be sent on request.

6 Tons (Model B-2) One of more than 30 models. Press with base, $519.

1-ton Hand-D-Press. For small parts manufacturers. Press only, without valves, $232.

Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

HANNIFIN

HANNIFIN CORPORATION, 517 S. WOLF ROAD, DES PLAINES, ILLINOIS

ROUND TABLE *Discussion*

SALESMAN FOR A DAY

Is there anything to be gained by a machinist going out with a salesman for a day? Will he increase and broaden his conception of the product on which he works, or will it be a waste of time?

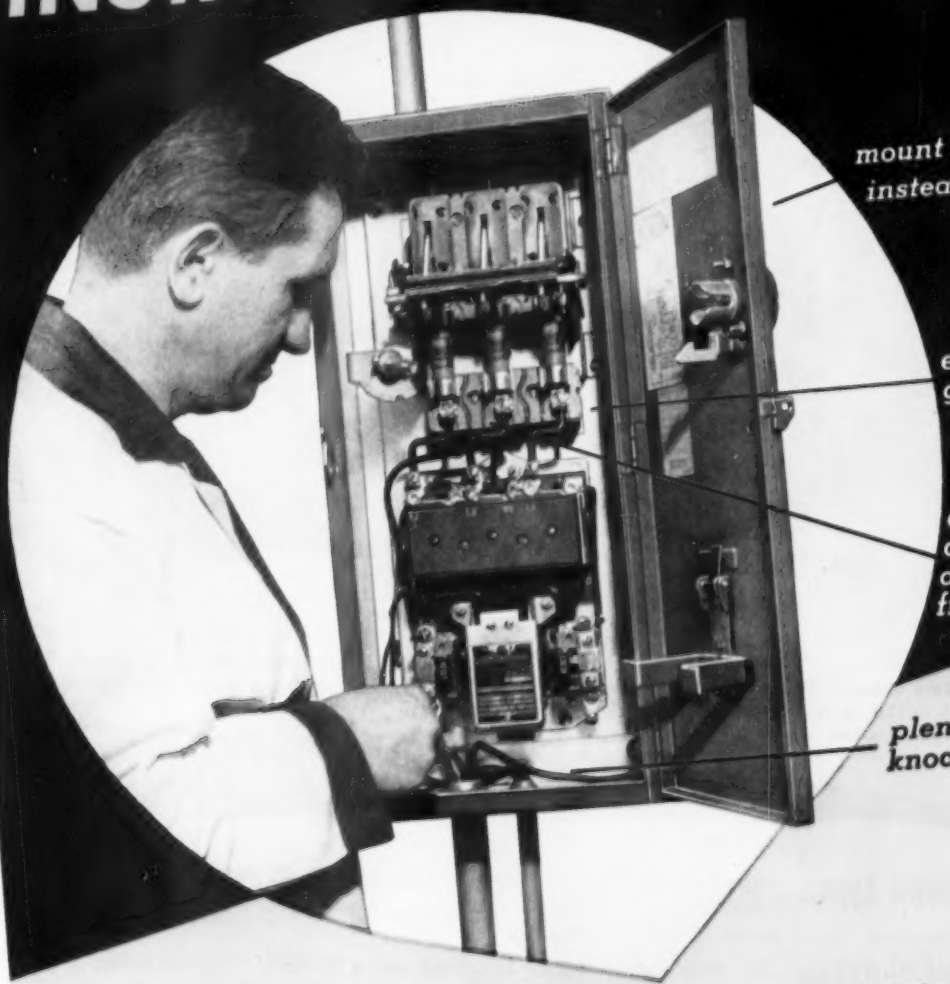
I DO not believe that the idea of sending out a factory employee with a salesman would be very effective. It certainly would take more than a day to point out the complications and pitfalls associated with selling.

It is recognized that many of our factory workers have a narrow conception of what it means to get the product into the consumer's hand. To them, sales and the men connected with this phase of organization have been looked upon as those with the sweet, sugared jobs and careers. The basic reason for this feeling among shop men is lack of information relative to the functions of the sales department. It is up to the individual managements through an internal educational program to dispel that philosophy, and point out that the sugar can be like the coated pill, it can be hard and bitter underneath.

The program should be designed to promote better teamwork through a better understanding of the functions of the sales and related advertising department. Effective use of graphic posters and pamphlets telling the story would accomplish much

"In Paris . . . Jim says . . . let's visit some shops . . . well do you know how many machine shops there are in Paris?"

EASIER TO INSTALL AND MAINTAIN!



mount 1 device instead of 2

extra-wide gutters

all components accessible from front

plenty of knockouts

SQUARE D COMBINATION STARTERS

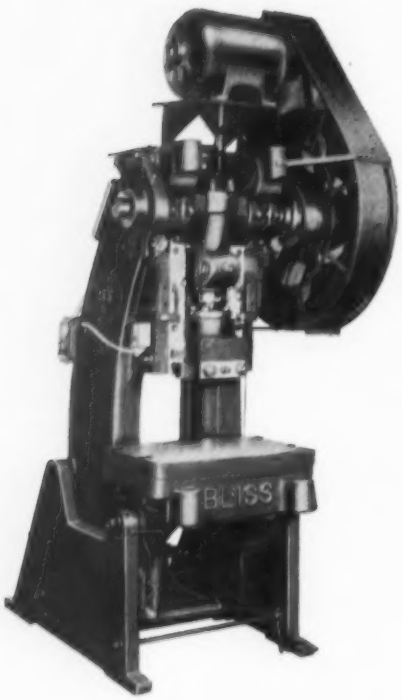
(Switch or Circuit Breaker Types)
Save space and time. Mount and wire one device instead of two... neater, more attractive installations.

Write for Bulletins 8538 and 8539
Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin

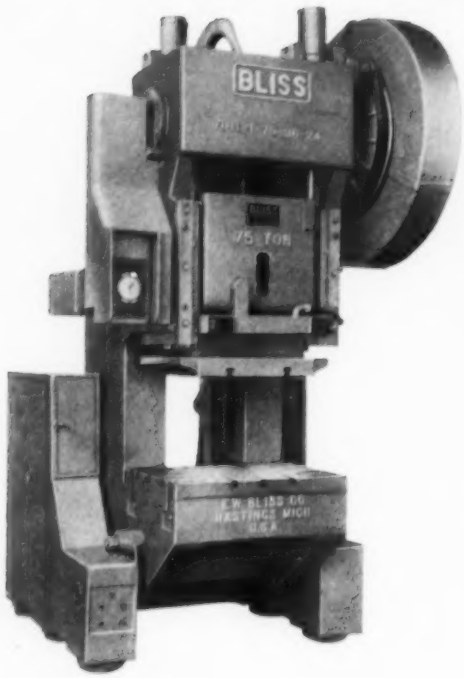
NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

Bliss inclinables offer you a wider



Standard Inclinable Presses—as furnished in the 10 to 125 ton range. No. 21-S press, 45 ton capacity, shown here.



Enclosed Inclinable Presses—75 to 200 tons. A 75-ton capacity model is shown here.

More standard types Bliss builds *23* standard inclinables—open-back inclinables, JIC inclinables, hydraulic inclinables, double-crank inclinables . . . offers a wider range of capacities and bed areas than any other make.

More standard clutches The Bliss Positive rolling key clutch and a choice of Bliss crankshaft or driveshaft mounted air friction clutches have been proved on thousands of presses. Bliss has the type of clutch best suited to your work.

More standard feeds Bliss designs and manufactures its *own* line of roll and dial feeds. This single responsibility for both presses and feeds is the press user's assurance that feeds are easily installed and easily adjusted.

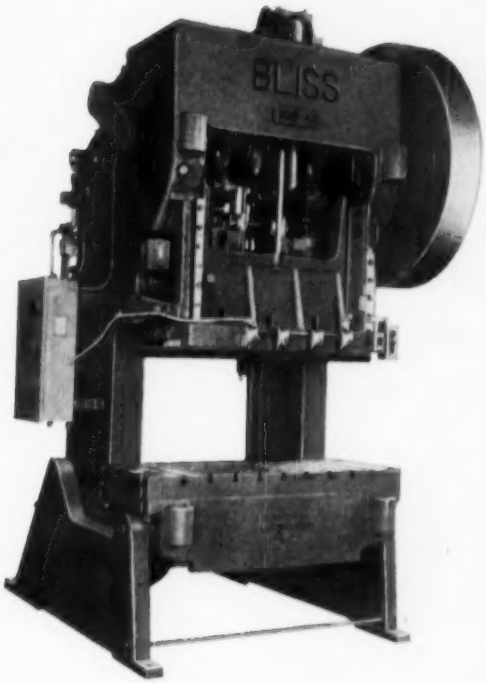
More standard cushions Five different types of cushions, in a range of sizes that meet every need, make any Bliss inclinable a double-action press. Cushions are especially designed for the press, and the presses designed to receive them—either assembled to press before shipment or easily installed years later.

. . . And a million dollar parts and service program to protect your investment!

Because Bliss *mass-produces* its inclinables, maintaining a stock-pile of spare parts is a simple matter. The million-dollar inventory of spare parts of Bliss' inclinable plant is by far the largest in the industry and includes clutch plates and parts, shafts, gears, pinions and the like. Moreover, Bliss maintains a separate, specially-trained organization whose sole purpose is to service your spare parts needs as quickly as possible.

choice of standard types and sizes

Standard Enclosed Inclinable as furnished in 150 and 200 ton sizes. No. 29, 150-ton capacity, is shown above.



Double-crank Inclinable Presses—from 18 to 175 tons. No. 108, of 100 tons capacity, is shown here.

A few of the reasons why BLISS inclinables outsell all other makes

. . . and always have

- Cast Meehanite frame—stronger, tougher. Fine grain structure dampens noise and vibration.
- Clutches—whose design has been proved by the thousands now in use.
- Gibs are close fitting, extra long, and insure accurate slide alignment at all points in the stroke. Simple to adjust so that original accuracy can always be maintained.
- Choice of hand, semi-automatic or automatic lubrication.

NEW catalogs now available

32 pages—describes frames, feeds, clutches, cushions and complete line of open back and enclosed single-crank inclinable presses. Gives dimensions and specifications. Catalog No. 2-D.

12 pages—describes these versatile extra-width double-crank presses. Gives dimensions and specifications for entire line. Catalog No. 3.

BLISS
SINCE 1857

BLISS is more than a name . . . it's a guarantee!

E. W. BLISS COMPANY, Canton, Ohio

Presses, Rolling Mills, Special Machinery

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pa. *Branch offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Pittsburgh, Philadelphia, Rochester, Salem, San Jose, Toledo, Washington, D. C.; and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

to serve you

A call to any one of our seven warehouses will get you speedy service on your order . . . whether it's for ***alloy steel bars, billets or forgings,*** in any size, shape or treatment you need.

All seven warehouses are located in principal industrial areas. Each is modern and well-stocked, and staffed by expert metallurgists.

Call now if you need our own HY-TEN steels – "the standard steels of tomorrow", or standard AISI or SAE grades.

Or write for *free* copies of Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

In Canada: Sanderson-Newbould, Ltd., Montreal and Toronto

WHEELOCK, LOVEJOY & COMPANY, INC.

137 Sidney Street, Cambridge 39, Massachusetts

more than a day with a salesman. The story should stress that in this competitive era a product no longer sells itself, and because of this, sales has become somewhat of a science with its many attendant technical as well as human problems.

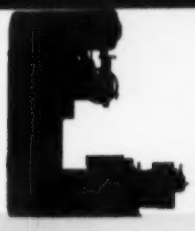
Very few men in the shop understand the significance of sales forecasts, and how material purchases and production schedules are established as a result of these forecasts. They perhaps do not realize that as a result of these forecasts, the sales goal of every salesman is established, and that it is just as important, and sometimes much more difficult, to meet these goals as it is to make production schedules or pieces per hour.

A printed story of one of those days that a salesman experiences during his career when he is knocked from pillar to post by a buyer because of quality shortcomings or delivery failures is a very effective tool in bringing out a better understanding of sales problems.

In the final analysis the two irritants, namely poor quality and failure to produce when needed, could be removed to a great extent by selling sales to the shop.

Peter L Budwitz
New Britain, Conn

AL'S IDEA is not very hot; in fact it is pretty cold. Sending a machinist along with one of the salesmen would, in all probability, accomplish nothing. It would be like having the salesman tag along with the machinist for a day to teach the salesman that the machinist's work is a lot more than just setting a few dials and then pushing a start button. If the machinist was an expert crafts-



NEW QUILL BEARING DESIGN helps achieve extreme precision in Fosmatic Jig Borer

To bore with precision as close as ±.0001", distance between cutting tool and lower quill bearing must be held to a minimum. Here's how Fosdick minimizes this crucial distance.

The lower quill bearing is *permanently* located at the lowest possible position in the head, permits boring with spindle nose as close as 2½" to the bearing. Bearing does not ride up and down with quill and spindle as in conventional designs where balls are held in moving bushings.

The permanent location of quill bearings is made possible by unique Fosdick design—vertical ball races with preloaded precision balls circulating continuously. This design also permits spindle and quill to be shorter; thus stronger and more rigid. Both are perfect cylinders with no cuts on the outside.

Engineering advancements like this make the Fosmatic Jig Borer the most rigid and precise boring machine you can buy. Write today for the new catalog.

Eight models available from the low-cost Model 30 with 36" x 18" table, to the virtually automatic model 54P with 54" x 22" table. Other important features: Automatic Positioning, choice of two precision measuring systems, milling feed, rapid traverse to quill, power clamping of table and saddle, coolant system and reversing motor control for tapping.

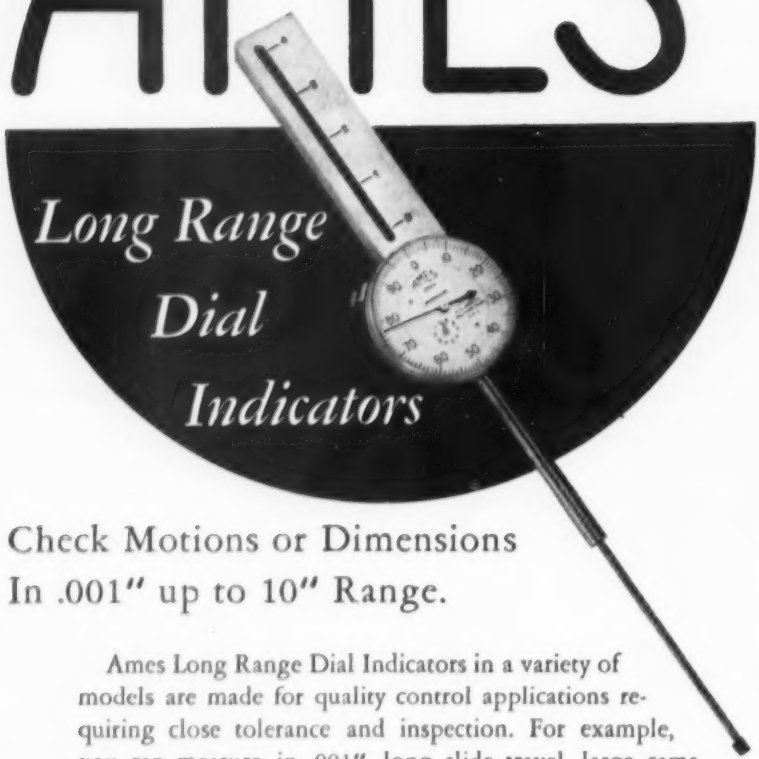
NEED JIG BORING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!

Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK

AMES

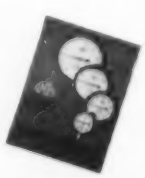


Check Motions or Dimensions In .001" up to 10" Range.

Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:— dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications – your answer will be back faster if you do.



Representatives in principal cities

B.C. AMES CO.

26 Ames Street, Waltham 54, Mass.

MANUFACTURER OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

man the salesman would probably finish up with the idea that the machinist's job was a cinch; it would appear that using a machine, say a lathe, was simplicity itself: "Bolt a sharpened bit of steel in a clamp, set a dial, jiggle a couple of levers, and push the start button and the machine does the job," he would tell his friends.

It is quite usual for people in one line of business to believe that the other fellow's job is a cinch. Watch a glass-cutter at work trimming off narrow strips of glass, making fast sweeping curves and cutting to close dimensions; nothing to it, just like cutting paper. Well, pick up the wheel-cutter some time and try that art. It seems that only by actual experience, including a lot of failures and botched work, can anyone finally realize that to become a craftsman it is necessary not only to study but to actually develop a personal sense of touch, skill, and close attention to every detail. This is imperative for that kind of knowledge cannot be gained by just watching an expert for a few hours.

It is true that a great many shopmen believe that the company is making an ungodly amount of easy money, particularly when they see the store price-tag on something similar to what they are turning out. They wonder why that store is getting 67c for that doodad which can't cost more than a dime. They may say, "I am turning out things just about like that on my forming press at 40 a minute!" They forget the overhead, the taxes, the building and maintenance, the taxes, the packing and the transportation, the taxes, the jobber's and wholesaler's expenses and taxes, the trucking and delivery to the stores and taxes, the store building, maintenance and taxes.

The shop cost of merchandise fre-

"What're they yelling safety for. We ain't had any accidents for two years."

THE POSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

For those Tough Special Jobs

Designed on

National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

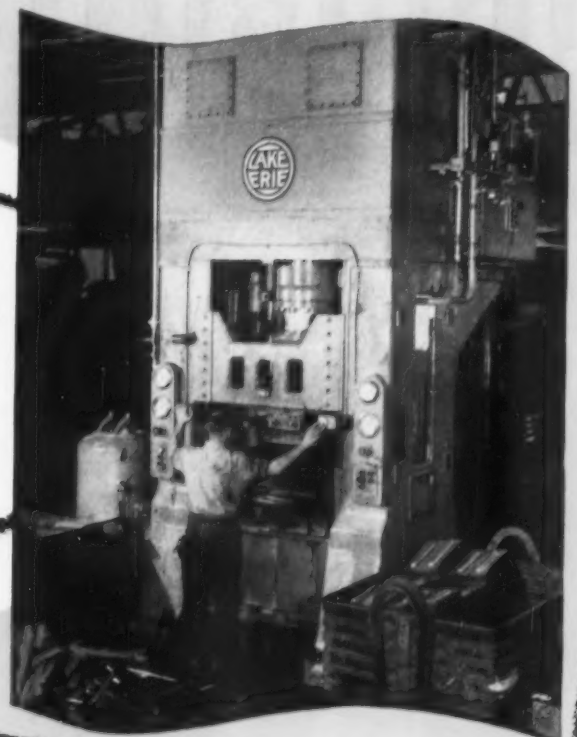
National Tools Cleveland

National TOOL CO.

Cleveland 2, Ohio

SURE SIGN OF SATISFACTION

...Repeat orders



ONE OF THE MANY
"Lake Eries" serving "IH" is this 200 ton, side housing, single action press with cushion. Press has an 18" stroke, 36" x 38" bed, closing and return speed of 750"/min., and pressing speed of 67"/min.

INTERNATIONAL HARVESTER

has re-ordered from Lake Erie **19 TIMES**

International Harvester Company ordered their first press from us in the early 40's . . . have added 21 more Lake Erie presses since then . . . and have a current order on our books. Drawing, forging, hot forming, bending, quenching and straightening are some of the many production operations performed by International Harvester with their Lake Erie presses.

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BUFFALO, N.Y. U.S.A.

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LAKE ERIE® ● Manufacturers of die casting machines and the most complete line of hydraulic presses for all industry.

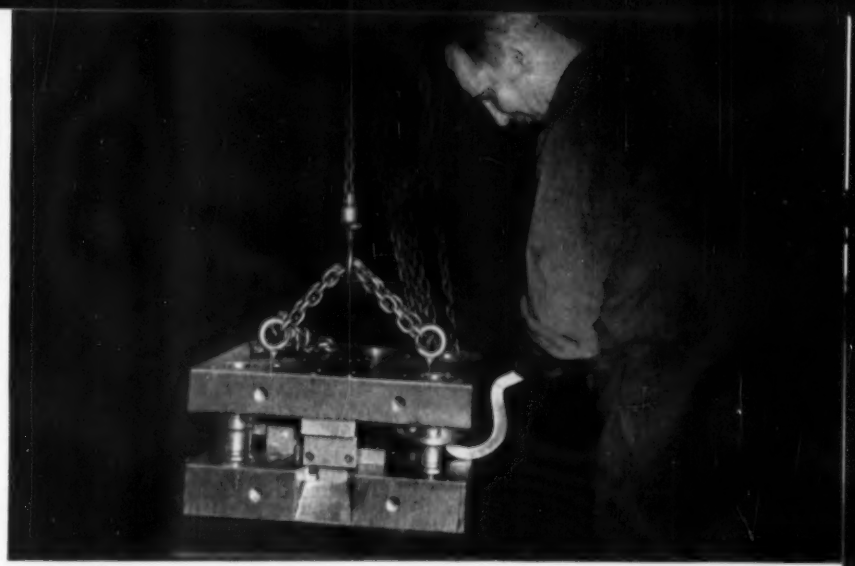
quently is but a very small part of the actual cost of the article when on the display counter. It is the final cost that determines whether the article can be sold at a profit or not sold at all and it is highly improbable that sending machinists out with salesmen on various occasions would have the slightest influence upon the final cost, except perhaps to slightly increase it. Better let the machinist devote his time to straight production.

George P Pearce
Albuquerque, NM

I THINK there are very few shopmen who have the idea that the salesman has a soft job, and the old idea that salesmen spent most of their time dining and wining their customers has been pretty well exploded. They do know that the salesman has to know not only his own product, but also that of his competitors, has to spend many hours on the road, and in some cases get to know his family only at the weekends. He has to keep informed on the gossip of the trade and be alert at all times for new prospects. The average shopman knows also that the salesman has to keep the orders for his product coming in, otherwise the shopman will find himself out of a job. In brief, the man who produces the stuff knows that in a highly competitive world, the salesman is a necessity, not a luxury.

I remember working for a small shop-owner who had developed a machine that showed promise of becoming widely used in the textile industry. For some reason this old fellow took a dim view of advertis-

"Look at it as an investment, Steve. Give a dime now . . . in a year you get a cigar!"



Cut DIE COST WHERE IT COUNTS MOST...

...BEFORE the die gets in the toolroom

Nothing makes a diemaker meaner than a sticky punch holder. Count the number of times he removes that holder building up a die and it's foolish to save a few dollars buying second-rate die sets.

That can't happen with Detroit Die Sets because . . .

. . . from start to finish, under one roof, Detroit Die Sets are continuously inspected for accuracy, whether it's turning a shank or superfinishing a guide pin. Misalignment doesn't have a chance.

. . we are constantly working to improve our die sets. Recently developed ball bushings are an example. Extensive testing, in our own and customers' plants, has proven their value on certain applications. Now, they're available on Detroit Die Sets to extend production runs as well as making the diemaker's job an easier one.

Details on the use of ball bushings plus other helpful information on cost-cutting Detroit Die Sets are available upon request. Write today, or see your local representative—he's as near as your phone.

Offices in Principal Industrial Centers

Detroit DIE SET CORPORATION

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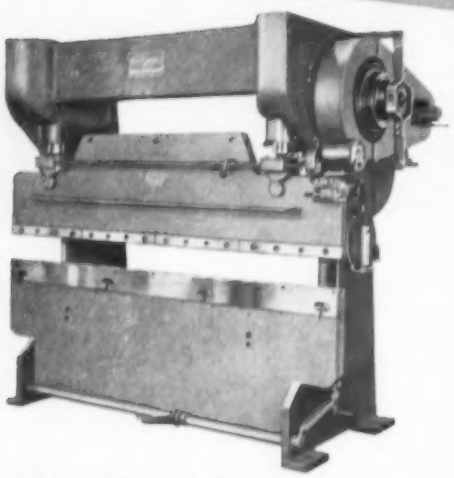
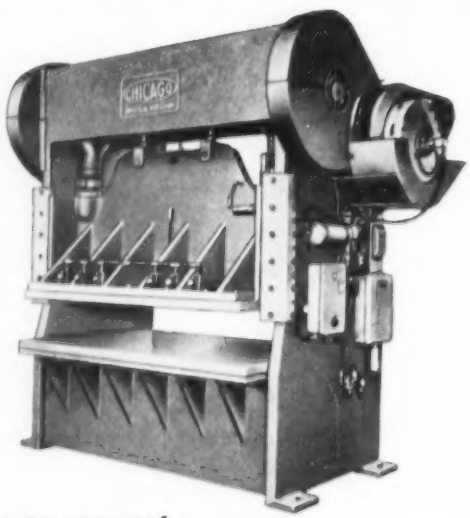
FASTER
Sheet Metal Operations



Beading
Bending
Blanking
Corrugating
Curling
Drawing
Forming
Joggling
Multiple Punching
Trimming

CHICAGO Press Brakes
Five Models for Sheet Metal Work
11, 30, 36, 50, and 60
Ton Capacities



CHICAGO Straight-Side and Gap Presses with Large Die Area for blanking, punching, trimming, and shallow drawing. Custom built to individual requirements in stroke, die space, and bed area.

Descriptive Literature on request

6161

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Press Brakes • Straight-Side Presses • Press Brake Dies
Hand and Power Brakes • Special Metal-Forming Machines

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MANUFACTURING CO.
7434 South Loomis Boulevard, Chicago 36, Illinois

ing, and salesmen. He insisted that salesmen and advertising were "all right for the big fellows—but were liable to eat the little fellow out of house and home." For a time his machine enjoyed a localized popularity, and the shop was kept running at capacity. Then the industry went into one of its doldrums, and the shop barely made expenses. He was finally persuaded to put his machine in the hands of a salesman who made a practice of carrying several small accounts over an area that extended into Canada, and sure enough business began to pick up. Then the salesman sent in his bill for services rendered. When the old boy saw it he hit the ceiling, although to my way of thinking the salesman's charges were reasonable, considering the new contacts that had been made and the machines that had been sold. However, he paid the bill, but he also took his account from the salesman. Then, as before, orders began to dwindle and, after a period of running at low capacity, the shop finally folded and the old man put his machine on the market.

Here was a clear case where money judiciously spent on salesmanship and advertising would have insured employment to nine or ten men and a comfortable living to the shop-owner. But his stubborn devotion to his prejudices, and his disinclination to spend money to keep his product from being known more widely proved his undoing. It may have been true once that "the man who makes a better mousetrap will find the world beating a path to his door." Nowadays he has to make sure the world knows about his better mousetrap, and keep on telling the world about it. I think the vast sums of money spent on radio and television time make that very evident.

If a company can afford to lose the

"I'm sure you won't mind getting set up for this cut again, Fred,—I want to give this new man a few pointers."

2895 WEST GRAND BOULEVARD • DETROIT 2, MICHIGAN

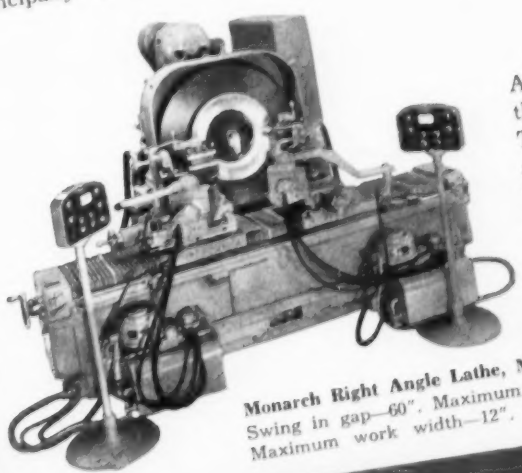
THE MONARCH RIGHT ANGLE IS YOUR BEST ANGLE

. . . for the turning, boring, and facing of thin-walled work pieces having large diameter and short length.

Here's a specialized chucking machine for optimum output—for every plant producing this type of work in sufficient volume.

For instance: large metal gaskets—large refrigerator compressor discs—miscellaneous disc and ring work—specialized mold work—tire rings and mold shells for tire manufacturers—large diameter housings. And, of course, jet engine components such as discs, wheels, rings, spacers, vane assemblies, shrouds, and so on.

Specifically, you get such Monarch specialties as Air-Gage Tracer controls, completely automatic turning cycle with push button control, power angular feed, in-built constant surface cutting speed on the Model F (principally for facing), and dual slides on the Model O (principally for turning and boring).



Monarch Right Angle Lathe, Model O.
Swing in gap—60". Maximum turn diameter—48".
Maximum work width—12". Motor size—20 H.P.

All the features and uses of this machine would fill a book. They do, and we have it. Just ask for Booklet #1401 . . . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

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TURNING MACHINES

FOR A GOOD TURN FASTER . . TURN TO MONARCH

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See page 11
WHAT'S THE MOST ECONOMICAL WAY?
See page 9
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answers many questions that mean better production, more profit for you. Just look at the table of contents:

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services of a skilled shopman for a day or two it might give him a broader viewpoint and make him a more valuable employee when he got back in the shop. At any rate it would convince him that the best way to keep the salesman bringing in orders is to keep on turning out a quality product.

Robert S. Alexander
Glastonbury, Conn.

AL, AS in most cases it seems has the broader view of the shop, of men, and of life in general. It not only broadens a mechanic's knowledge of the world in general and of his business in particular, but helps him to know what the users of his product think of it. It would be particularly good for men who assemble the machines to know how often the salesman's greatest resistance to making a second sale comes from poor assembly of a previous machine, or product.

Modern machining operations have made it possible to produce parts more nearly uniform than was possible a few years ago. Taking automobiles as an example—parts are being made to closer tolerances than ever before. But every automobile dealer knows that he is very sure to find "bugs" in the cars he has to sell. In spite of greater accuracy of parts, assemblers seem to leave off as many nuts and other parts as before. As one driver who had his front wheels "spread-eagle" because a bolt came out remarked afterwards, "If they would only tell us what nuts they leave off it wouldn't be so bad. We could put them on ourselves."

Recently a car in the highest price

"Incidentally, fellows, there's been some criticism about too much power on the get-away at quitting time"

Warranty: 16 oz. of First Quality in every pound!

DIE STEELS FOR HOT WORK

Produced by Vanadium-Alloys Steel Company to *first quality* metallurgical and performance standards, these die steels match every hot work need in the metal-forming industries. They are the specialized products of tool steel specialists, made in a plant devoted exclusively to fine tool steels. Let our district sales engineers aid you in selection and application—their trained services are yours without obligation of any kind.

Hotform — The most widely used of all hot work die steels. 5% chromium—tops in strength and toughness, plus resistance to heat checking. Use for die casting, extrusion and hot forging dies, backer blocks, mandrels, etc.

Hotpress — Tungsten Die Steel with additional toughness for high temperature work. Outstanding on dummy blocks for brass extrusion, upsetting dies, extrusion dies, and press dies.

SC Special — 14% Tungsten Die Steel with increased carbon for better wearing properties. Particularly adapted for extrusion punches, piercers, and forming dies.

Marvel — 10% Tungsten Hot Work Die Steel for tools requiring better resistance to high temperatures. Excellent for punches, nut piercers and dies, and brass forging dies.

Red Cut Superior J Temper — Tungsten High Speed Die Steel for high temperature service, having excellent hot hardness properties and wear resistance. Outstanding on extrusion dies, hot press dies, trimming dies, and punches.

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WW Hotwork — High Alloy Steel developed for maximum wear resistance at elevated temperatures. Used for copper and brass extruding dies, brass die casting dies, piercers for copper tubing, and nozzles on zinc die casting machines.

WCC — New, very deep hardening tungsten, chromium, cobalt and vanadium steel—outperforming 9-5-0 tungsten types. High resistance to wear and thermal fatigue. Use for hot extrusion dies, permanent molds for brass casting, forging die inserts, hot-press dies.

Vanadium-Alloys Steel Company

Latrobe, Pennsylvania

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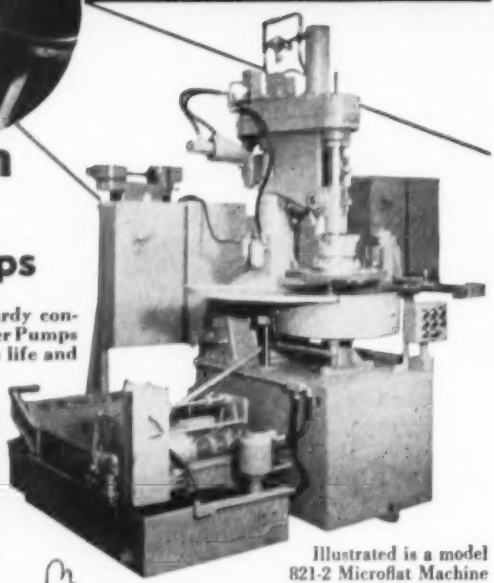
Designed to do a better job

Ruthman Gusher Coolant Pumps

The simple designs and sturdy construction of Ruthman Gusher Pumps assure you long trouble-free life and efficient operation. There are fewer parts to wear, prelubricated heavy-duty ball bearings require no further lubrication — electronically balanced rotating assembly cuts vibration to minimum. So be sure to specify the pumps that are designed to do a better job . . . "Gusher" Pumps.



Illustrated is a model 821-2 Microflat Machine equipped with a "Gusher" Coolant Pump— Photo courtesy of Micromatic Hone Corp.

THE RUTHMAN MACHINERY CO.
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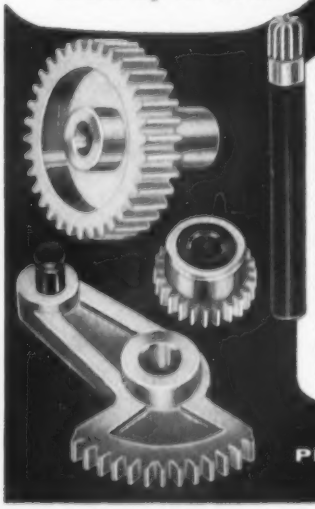
NOW!

new economies in NYLON GEARS

means savings in gear costs up to 90%



Our many years of pioneering and successful production of Nylon Gears, plus new reduced mold charges, can now make even greater economies for you in the use of Nylon Gears. With the great variety in molds now possible, Nylon should not only be considered as an economy measure but the answer to many problems where a compact design is necessary. Nylon Gears are quiet, durable, efficient and need less lubrication – they mate perfectly with metal gears.

Let our engineers with more than a decade in gear experience show you how Nylon Gears can save you money – let us consider your gear problems during the design process–send blueprints or specs for prompt estimates.

105

PROCESS GEAR CO., INC.
4614 W. Fullerton • Chicago 39, Illinois

bracket reached the dealer minus parts of the chrome trim on the inside, with brakes out of adjustment, and other faults that had to be corrected before the car could be delivered. The money that dealers have to allow for putting cars in shape for delivery is one of the headaches of the trade.

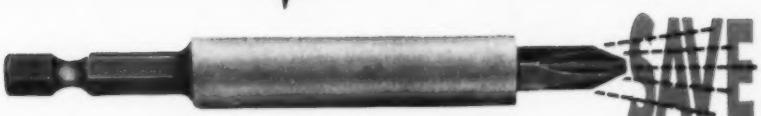
To a lesser degree, probably, this holds true in other industries. Parts get by inspection that are no credit to either the worker or the factory. This is being reduced by the newer machines and inspection methods. But even perfect parts are often assembled into a machine that does not satisfy the customer. Men who have had a wide experience with foreign cars, which are assembled in their own factories, report greater attention to details than here. Possibly our own shops pay more attention to details of cars going abroad?

If assembly-line mechanics could be shown the cost of correcting their mistakes and omissions, it might result in greater care in their work. Those who are supposed to supervise assembly and to give final inspection, would also benefit by seeing the delays and costs of remedying their mistakes.

There is also another phase to this suggestion. Men who go out with salesmen to other shops might, in addition to seeing where their own work could be improved, understand the salesmen's problems and see an opportunity for their own advancement. Some of the best machine salesmen I have known have moved into the high salaried brackets, from going out on "trouble shooting" jobs with salesmen. When they can combine salesmanship with knowledge

"I'll bet I've made a million of these things Joe . . . what the heck are they. . . ?"

APEX Magnetic Tools

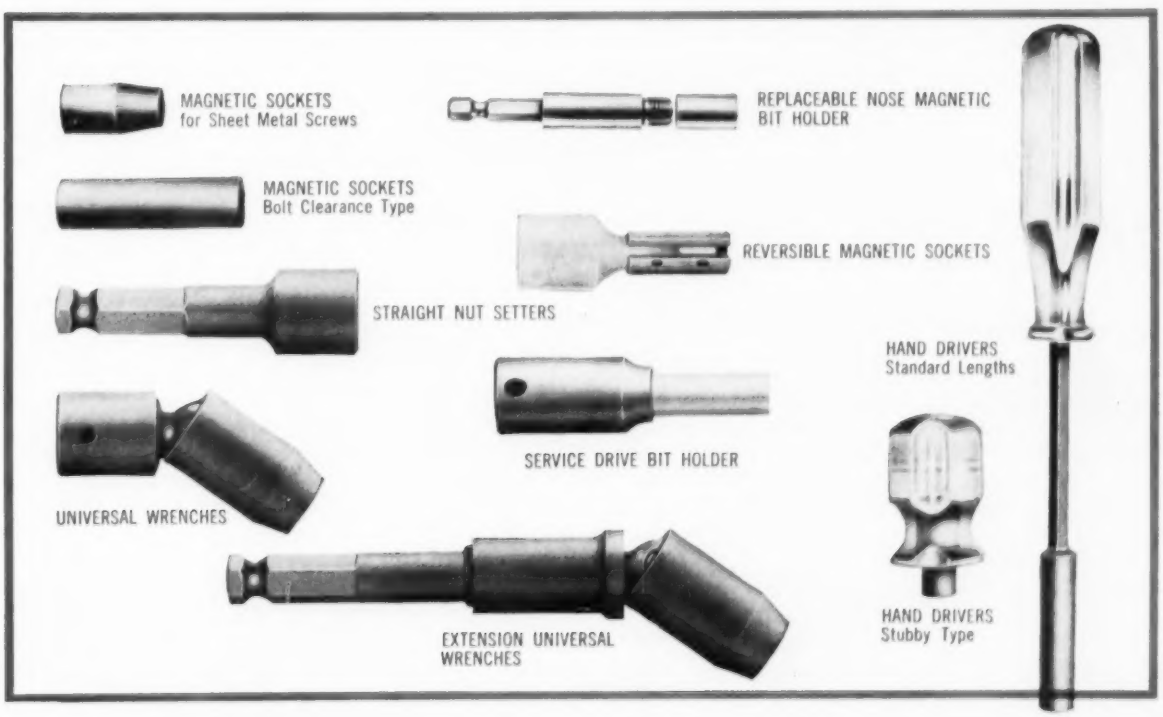


SAVE TIME

REDUCE COSTS

"Like having an extra hand"—that's what operators say about Apex magnetic nut running and screwdriving tools. There's no time lost in awkward fumbling to start screws or nuts by hand. The powerful Alnico magnet in Apex fastening tools attracts and holds the screw or nut firmly in driving position, makes it easy to drive screws or run nuts at any angle—even straight down—and in those hard-to-reach spots.

If you're not using Apex magnetic tools on your fastening operations—production or maintenance—better check right now to learn how you can make attractive savings in time and costs. Catalog 25 contains complete information; write, on your company letterhead please, for your copy.



Ask **APEX** *for the answer to your fastening problem!*

THE APEX MACHINE & TOOL COMPANY

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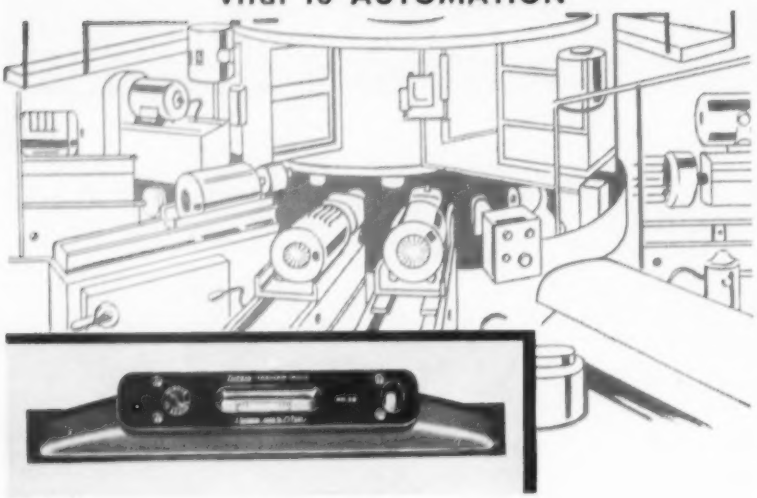
LUFKIN LEVELS

provide the perfect alignment vital to AUTOMATION



No. 59

Automation machinery requires perfect alignment to operate smoothly and without undue wear. Stoppages for adjustments and repairs can be reduced to a minimum by using reliable Lufkin Levels for perfect initial alignment and maintenance.

LUFKIN MASTER PRECISION LEVELS

Lufkin Master Precision Level bases are hand scraped to exacting tolerances to provide true surfaces without excessive cohesion. They provide true horizontal settings to 10-second accuracy. Each division on the graduated glass vial equals .0005 inches per foot.

Special aged iron alloy base has less temperature change and an extremely rigid construction. Non-conductive top plate resists effect of body heat. Tamper-proof adjustment. Height 3", length 15" and width 1½".

LUFKIN MACHINISTS' LEVELS WITH V-GROOVE BASE

No. 57 PLAIN VIAL
No. 58 GRADUATED VIAL

"V-GROOVE" bases provide a broader bearing surface for more accurate seating on any size shaft. Choice of plain or ground glass graduated vials, 60-second accuracy with one declination line equal to .0035 inches per foot. Cross and plumb vials, with main vial protected by metal tube which turns to expose graduations. Levels furnished in 6", 8", 12" and 18" lengths.

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Consult your Industrial Distributor

- He has the answers to "Where can I get it?" at his fingertips — often from stock for immediate delivery.
- His experience gives him a sure answer to your question, "Is this the best solution to my particular problem?"

425

of the machine itself, they have a great advantage.

Fred H Colvin
Point Pleasant, NJ

NO TIME TO THINK

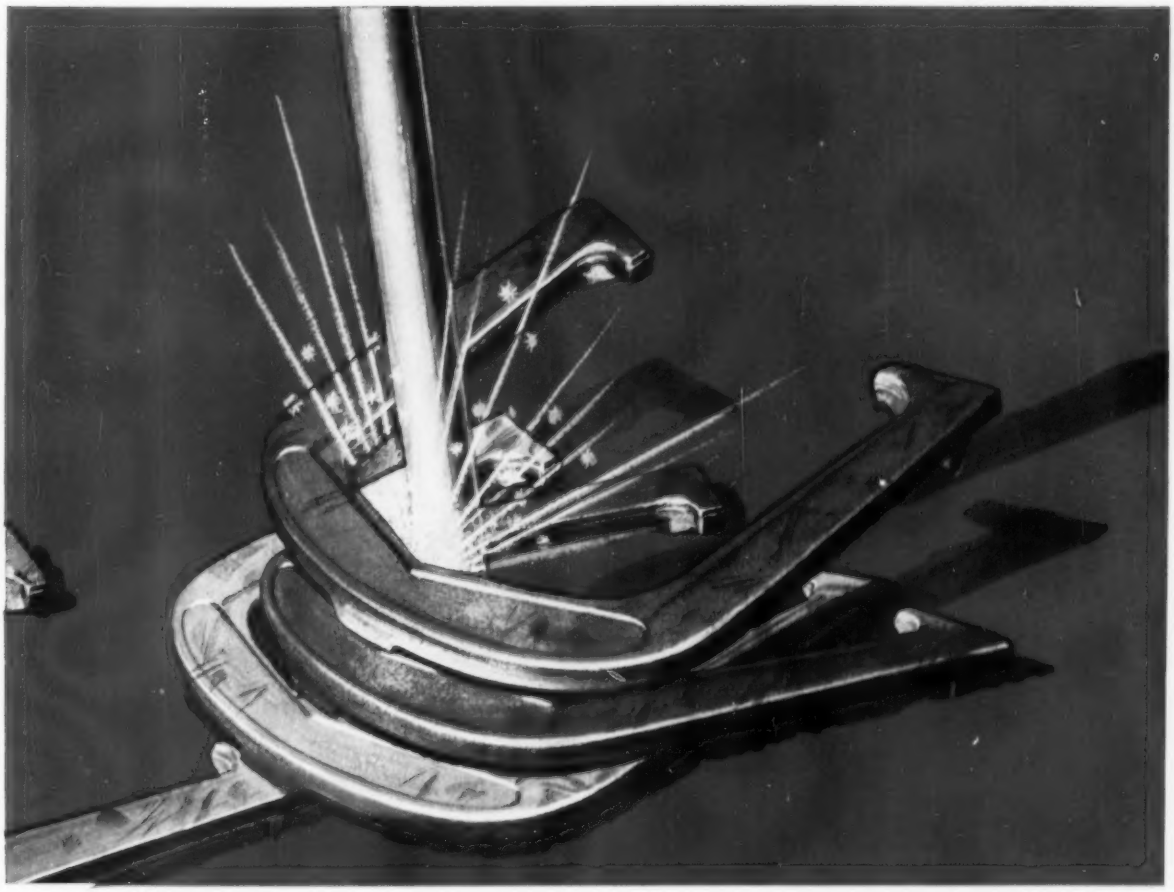
Is it necessary for a foreman to be available at all times to answer questions, solve problems, and keep close check on the men? Or can his day be better organized so that he has time to read, study reports, plan schedules, etc?

ANSWERING questions is just one of the many phases of the foreman's work. Before we can decide what attitude the foreman should take toward the employee's questions we must decide just why these questions are being asked.

All human beings are possessed of self-assertiveness; it is the usual human desire for distinction and recognition. The man in the shop is working directly under his foreman, and there are few others in the company at higher levels who even know the man's name. The man spends eight hours a day in the shop, about half his waking hours, and his very nature demands recognition for what he is doing during this time. If the foreman fails to give him this recognition he tries to attract it by showing the foreman what he is doing. The only way that he can do this without appearing obvious is to ask the foreman a question, real or otherwise, about the job.

There is a desire in every normal individual for admiration and recognition, and it may lead to a great expenditure of energy in the hope of impressing one's superior. Almost everybody wants to be somebody, and somebody a little better than anybody. Many of the questions asked by the employees are directly

"There's the kind of employees I like, low salaried."



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...with J&L COLD FINISHED JALCASE STEELS

Cold Finished Jalcase—now available in 10 SAE and AISI grades—is the original free-cutting open hearth steel having the mechanical properties required for special service machined parts. And it's especially suitable for heat treating. This grade is one of a complete line of premium quality, free-machining bar steels developed over the years by J&L specialists. Thus, we can recommend the right type to help solve your particular problems.

Fundamental advantages of Jalcase are:

- **Easy, consistent machinability**
- **Minimum distortion**
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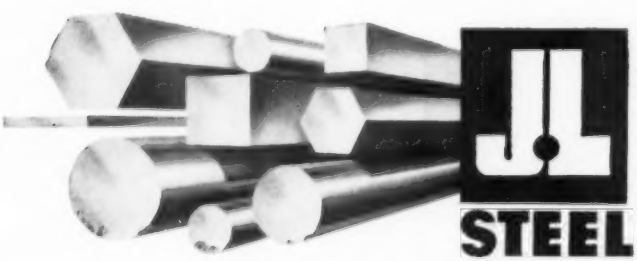
Adequate stocks are available in important industrial centers. Phone the nearest J&L District Office or your Distributor today for prompt and efficient service.

Pick the Free-Machining Steel that serves you best—from J&L's complete Cold Finished Line



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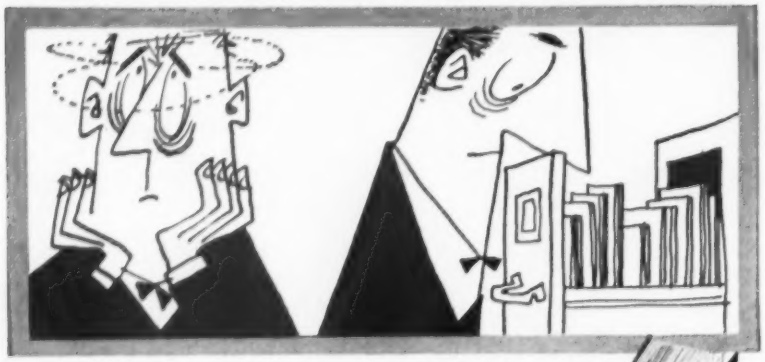
NEW MACHINE TOOLS ON YOUR MIND?



no need to wait...no need to hunt

when you want the facts on
today's best machine tools
here's the place to get them fast

Metalworking production's most convenient, always accessible source of machine-tool-buying facts.

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The High Quality Heavy Duty

EUCLID HOISTS

These hoists are highly efficient and strictly modern in every detail with oversize anti-friction bearings and heat treated steel parts in combination with a welded frame.

The planetary gearing and mechanical load brake are mounted in oil tight housings. The hoist gearing is assembled in the hoist drum.

This design produces an unusually compact, rugged and accessible hoist readily adapted to various installations and types of control.

Parallel mounted hoist with cone trolley drive.

Low headroom cross-mounted plain trolley hoist.

Write for the HB Hoist literature illustrating and describing the many features.

THE EUCLID CRANE & HOIST COMPANY

1367 CHARDON ROAD, CLEVELAND, OHIO

the result of the foreman's neglect of a basic psychological truth.

Those who manage like those who are managed, do not check their psychological equipment at the entrance to the factory or shop. In taking up the daily routine of employment, men and women do not escape from the traits that make up their behavior patterns both inside and outside the office or shop. Men and women remain on their jobs just what they are away from their jobs —just men and women. This is a simple psychological truth, but it is one that is quite generally forgotten or disregarded by those who are responsible for the administration of human relations in industry. It cannot be over-emphasized that the management of any enterprise is essentially the management of human beings in their relation to jobs and other human beings.

Unfortunately, even the asking of these questions may fail to bring to the individual worker the recognition he desires, so he tries harder and asks more questions. The solution lies not in the answering or not answering of these questions, but in an awareness of the need each employee has for recognition. Once the foreman sees this as the true picture he can take corrective action. Once he is willing to give each man individual recognition, the questions will decrease to just the necessary ones.

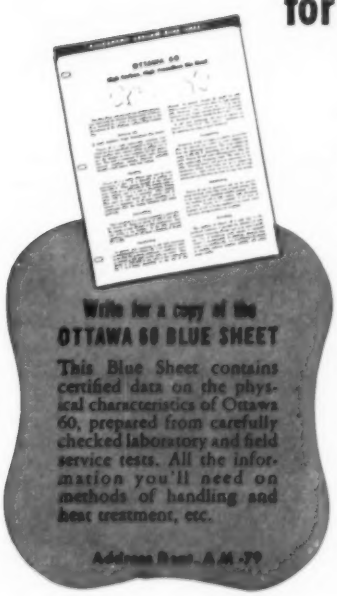
The foreman should make certain that he lets each employee know that the job he is doing is important, and that he knows what he is doing and how well he is doing it. If he recognizes and praises skill and ability the man will make every effort to do a good job, and will try to solve his own problems, for now he gets recognition for the answers, whereas he formerly got it with the questions.

H Koslow
Bronx, NY

"Your first child, Sam?"

OTTAWA 60

for DRAW DIES is *PRODUCTION NEWS!*


Write for a copy of the
OTTAWA 60 BLUE SHEET
This Blue Sheet contains certified data on the physical characteristics of Ottawa 60, prepared from carefully checked laboratory and field service tests. All the information you'll need on methods of handling and heat treatment, etc.
Address Dept. AM-79

In fact, this exclusive Allegheny Ludlum-developed die steel is mighty *good* news for any user of draw dies. Ottawa 60 is a high-carbon, high-vanadium analysis, initially designed for the primary purpose of drawing stainless steel.

In that service, Ottawa 60 does just exactly what it was developed to do: it performs without galling or pickup, and shows exceptional wear-resistance—as a long list of successful applications will prove to you. Two of them are illustrated above: a stainless hinge and a stainless sundae server.

But Ottawa 60 is a top performer on any draw die application! Also illustrated above are the two draws on a transformer housing of .037" gauge SAE 1010 strip. After more than 25,000 pieces—*over 12 times any previous runs*—there was still no sign of pickup, or of wear on the Ottawa 60 punch or die.

This analysis can solve your draw-die problem jobs—or reduce your costs on almost any drawing operation. ● Call on our Mill Service Staff for any assistance. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

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WAD 5581

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FINE TOOL STEELS
SINCE 1854

time to re-examine

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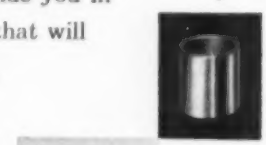
Striking cost reductions in bearing applications in many mechanical products are made possible by the use of Bunting Sintered Powdered Metal Bearings and parts.

Bunting engineering counsel can guide you in the selection of designs and alloys that will provide bearings of exactly the type, design and material that will fully meet both cost and functional requirements, whether the material be Cast Bronze or Sintered Metal.



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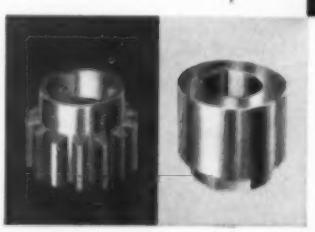
Write to our Product Engineering Department in Toledo or consult our nearest Sales Engineer.



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PROCEEDINGS OF 17TH SHOP PRACTICE FORUM—*Published by Porcelain Enamel Institute, 1145 Nineteenth St NW, Washington, DC. 174 pages. Price $5.*

The complete proceedings of the forum held in September, 1955, at Ohio State University and attended by 261 practical members. Subjects include porcelain enameling on aluminum, processing techniques, application and screening methods, architectural porcelain enamel, and color in porcelain enamel.

•

SUPERVISORS SAFETY MANUAL — *Published by National Safety Council, 425 N Michigan Ave, Chicago 11, Ill. 354 pages. Price $3.25 to members, $6.50 to non-members.*

Used as a text for group training or self study, this manual contains facts, ideas, and suggestions for top-notch safety supervision designed to give foremen a basic, usable knowledge of accident-prevention techniques and human-relations know-how. It can also serve as a standard reference work to provide a solution to virtually any general safety problem encountered in a normal workday.

The 12 chapters cover the human side of safety, maintaining interest in accident prevention, first aid, protective equipment, housekeeping, materials handling, machine guarding, portable power tools, and fire prevention.

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SIMPLIFIED PRACTICE RECOMMENDATION R259-56, HEXAGON-HEAD CAP SCREWS (CASE QUANTITY AND GROSS WEIGHT)—*Published by Commodity Standards Div, Office of Technical Services, US Dept of Commerce. Available from Supt of Documents, Government Printing Office, Washington 25, DC. Price 5¢.*

Proposed by the United States Cap Screw Service Bureau, this recommendation consists of a schedule of case quantities and approximate gross weights for hexagon-head cap screws ranging in size from ⅜ to 6 in. in length, and from ¼ to 1 in. in dia.

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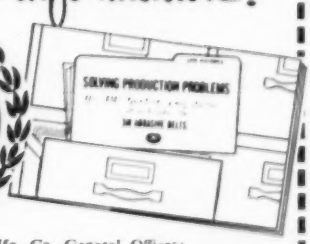

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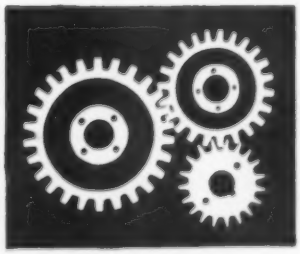

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Names in the News . . .

John D Gordon, formerly associated with Studebaker-Packard Corp, has rejoined Progressive Welder Sales Co, Detroit, as general sales manager.

James Vincent Huebner has been named assistant manager of the application engineering department of Formsprag Co, Van Dyke, Mich, clutch manufacturer.

Gilbert T Bowman, general products manager of Rockwell Manufacturing Co's Meter & Valve Div, and **J W Northcutt,** southern regional sales manager, have been named assistant vice presidents. **Jack W Walters,** product manager, petroleum and industrial liquid meters, succeeds Mr Northcutt.

William J Loach, executive vice president and co-founder of Firth-Loach Metals, Inc, McKeesport, Penna, has been elected president. He succeeds **L Gerald Firth,** who continues as director. **M A Cancelliere,** board chairman, will, in addition, take on the duties of vice president.

T H Price, vice president of Hill-Clarke Machinery Co, Chicago rebuilder of used machine tools, has been elected president of the company to succeed **Walter L Ditfurth,** who has retired. **R B Colter,** superintendent of the rebuilding plant, has been named vice president and works manager.

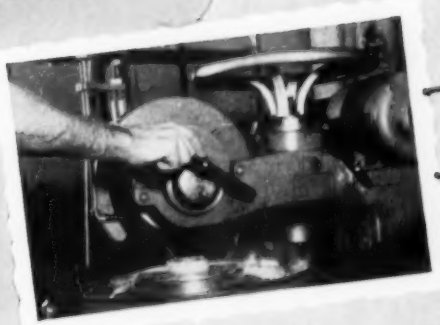
Stanley Lambert has been elected a vice president and sales manager of the Steel Division of Kurt Orban Co, Jersey City, NJ.

A James Fisher, technical advisor to the president of Metal & Thermit Corp, New York, has been appointed general sales manager.

James R Keough has been appointed manager of manufacturing at Fenwal Inc, Ashland, Mass, manufacturer of precision temperature controls. He has been serving as manager of purchasing and production activities.

Karl W Galliger has been appointed director of engineering for New York Air Brake Co. He has been serving as engineering manager of the company's Watertown Division.

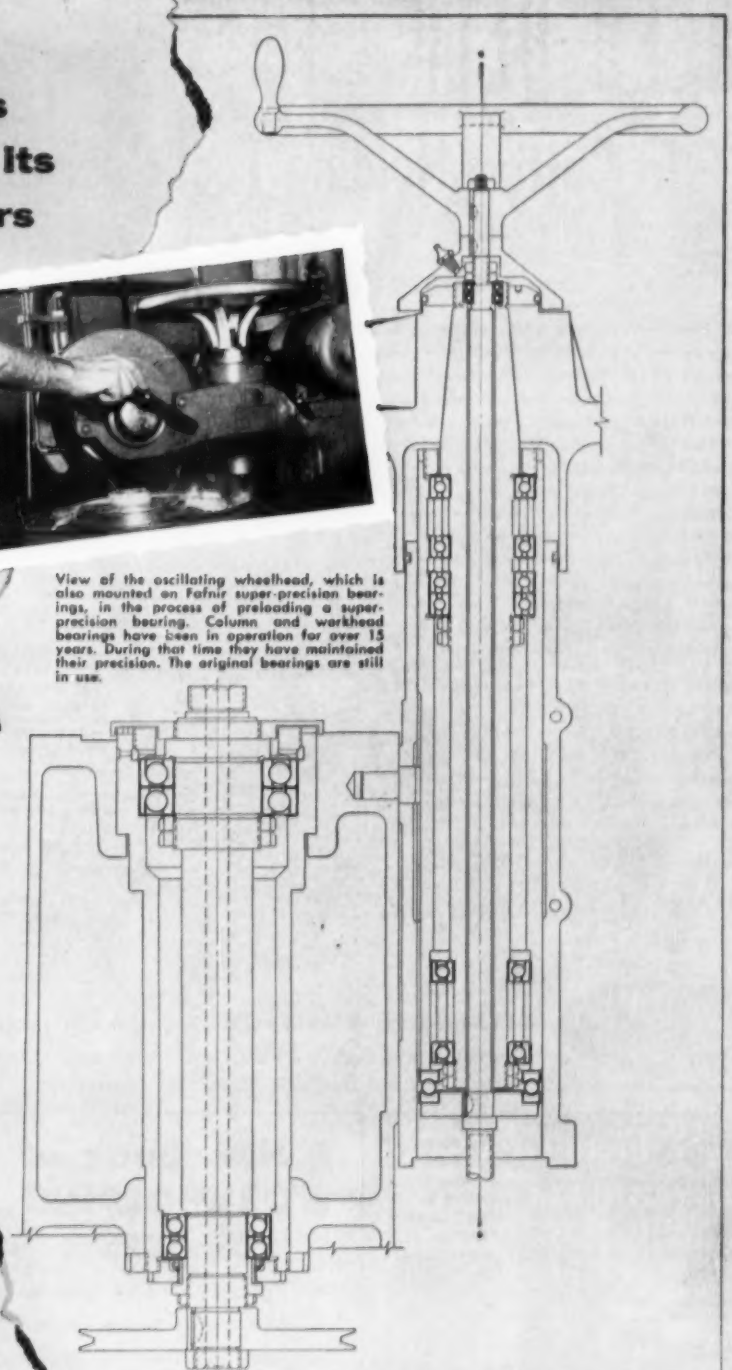
How a precision surface grinder is designed to hold its precision for years



View of the oscillating wheelhead, which is also mounted on Fafnir super-precision bearings, in the process of preloading a super-precision bearing. Column and workhead bearings have been in operation for over 15 years. During that time they have maintained their precision. The original bearings are still in use.

The job of preloading super-precision ball bearings calls for grinding precise amounts of stock from the faces of bearing rings. To obtain such results with a satisfactory degree of efficiency requires a grinder designed to maintain maximum rigidity and precise swiveling of its wheelhead arm plus precise rotation of its work spindle.

The diagram at the right shows how such rigidity is built into a precision surface grinder. All bearings indicated except the thrust bearing at the bottom of the column which supports the wheelhead arm are Fafnir super-precision, preloaded types. The use of these Fafnir ball bearings has resulted not only in work of dependable accuracy and finish, but also longer machine life. For other application data on Fafnir super-precision bearings plus dimensional and load rating details, write for Fafnir Precision Ball Bearing Catalog. The Fafnir Bearing Co., New Britain, Conn.



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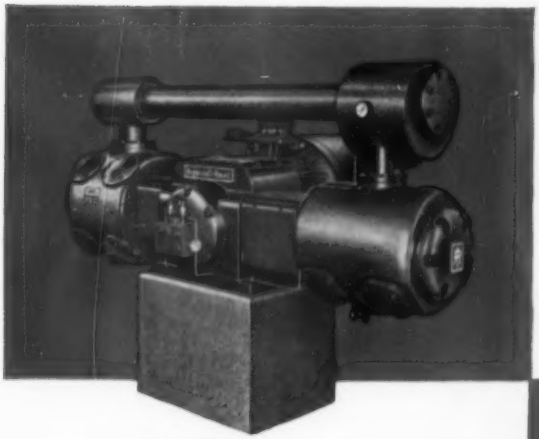

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- 75 and 100 hp packaged
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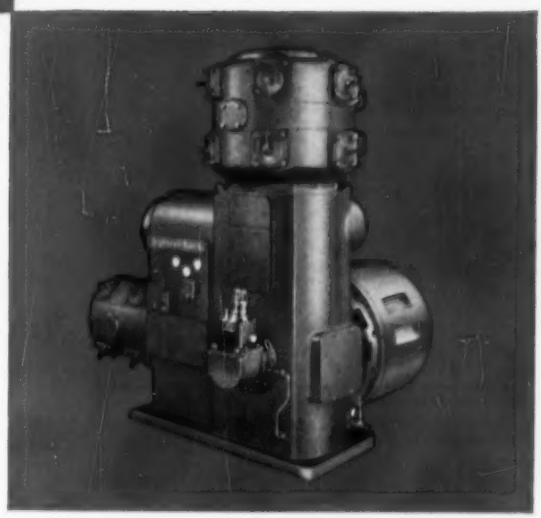

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- 125 to 250 hp packaged
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Full-floating aluminum bearings are foolproof, never need adjustment. They "roll with the punch" of every compressor stroke. Wear is distributed evenly around both inside and outside.

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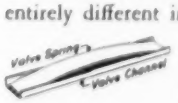

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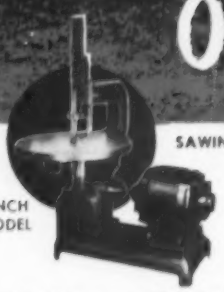

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Table	11¼" dia.	11¼" dia.	18" dia.
Tilt	10° to right, left or front	10° to right, left or front	15° to right, left or front
Strokes per minute	313 & 428	400	100, 125, 175, 215, 250 & 300
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Drive	V-belt	Direct	V-belt

*Also available in pedestal models.

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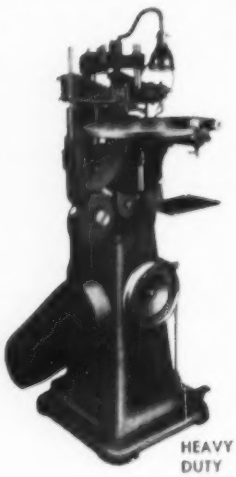

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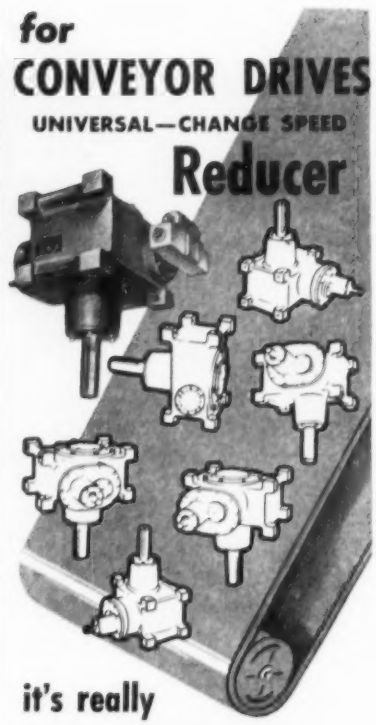

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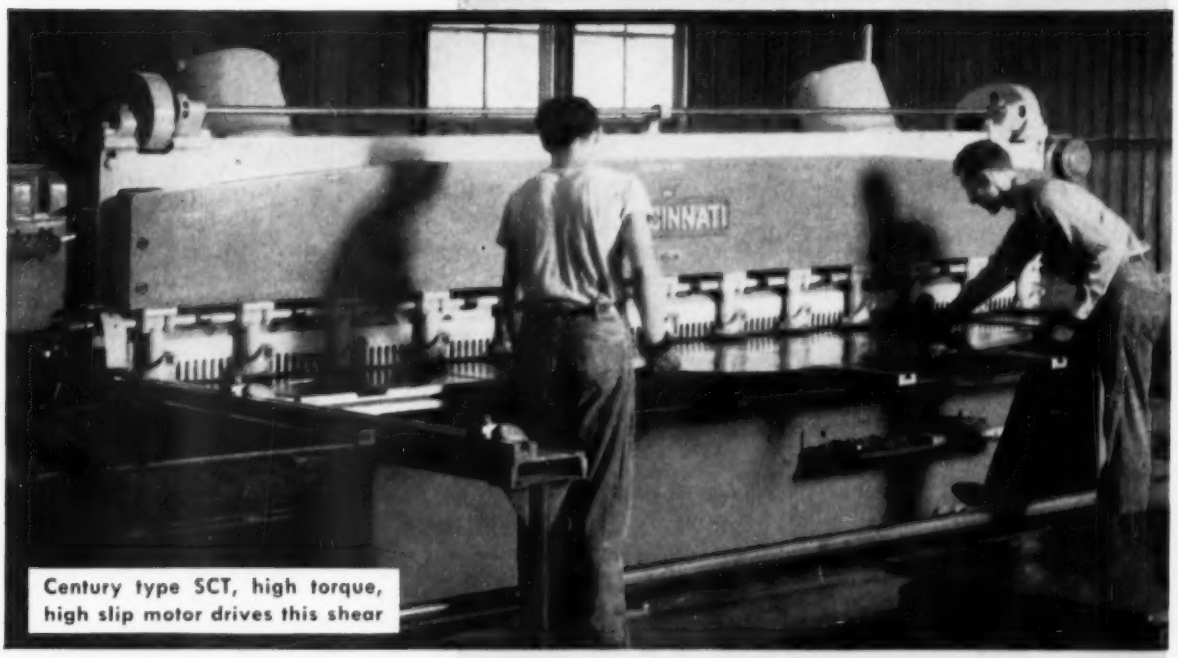

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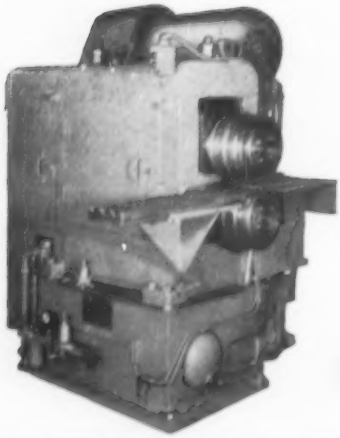
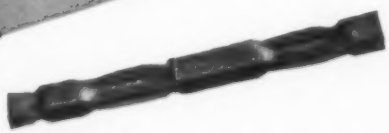


from the forging roll . . .



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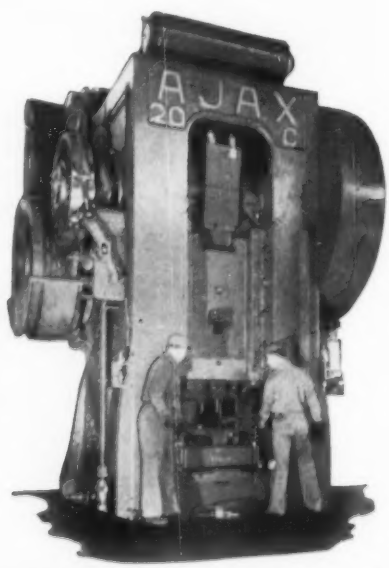
. . . to the forging press



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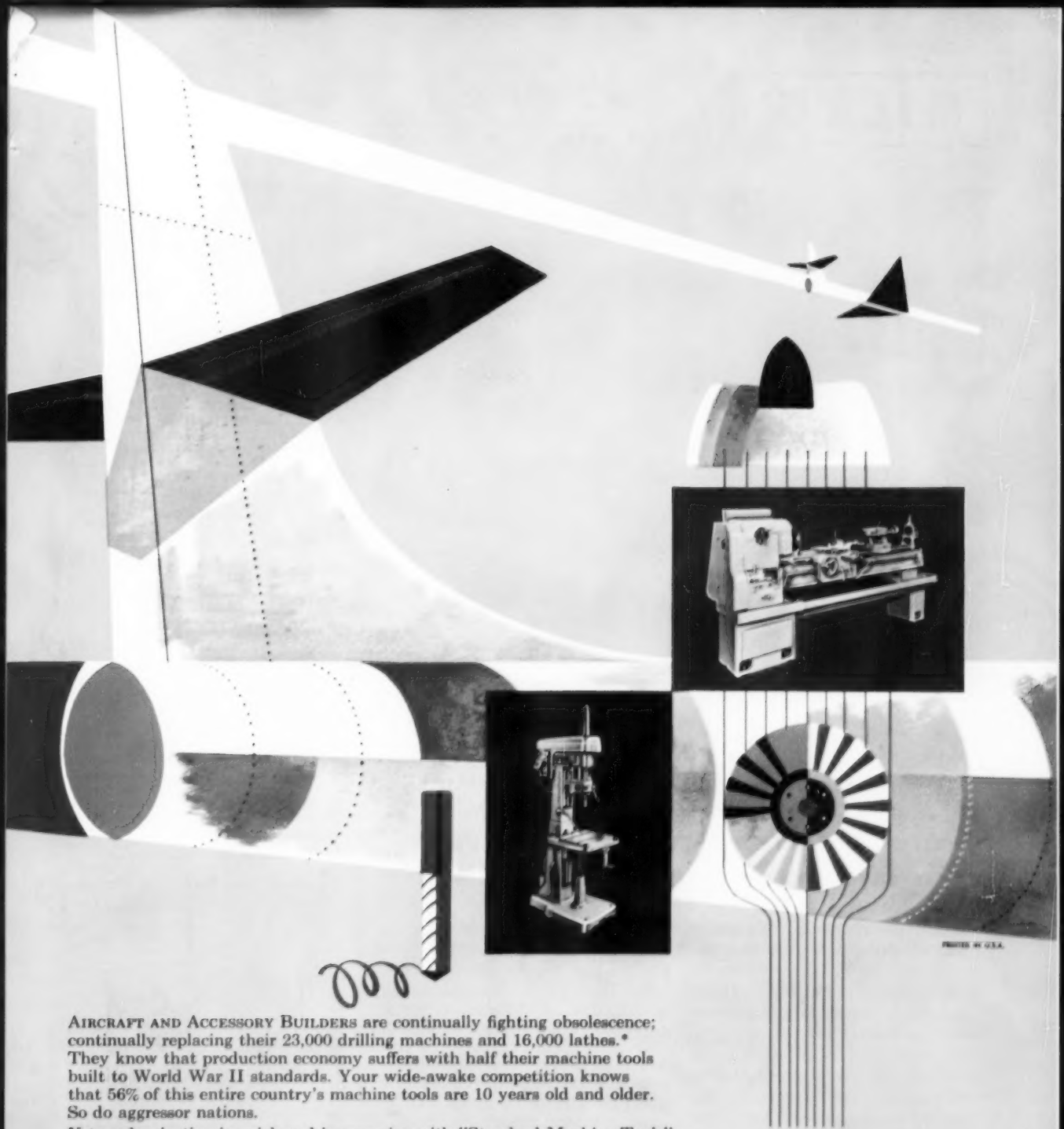


AIRCRAFT AND ACCESSORY BUILDERS are continually fighting obsolescence; continually replacing their 23,000 drilling machines and 16,000 lathes.* They know that production economy suffers with half their machine tools built to World War II standards. Your wide-awake competition knows that 56% of this entire country's machine tools are 10 years old and older. So do aggressor nations.

Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

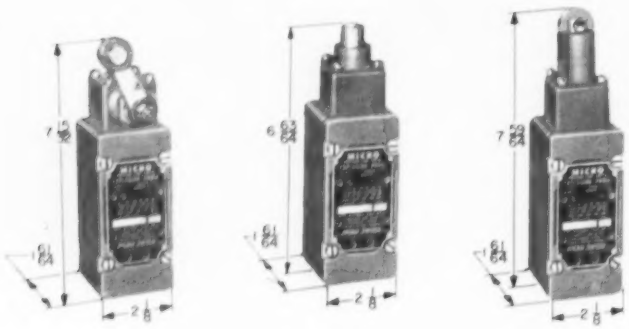
*Figures from American Machinist's Seventh Inventory.

center on... **cincinnati lathes and drills**

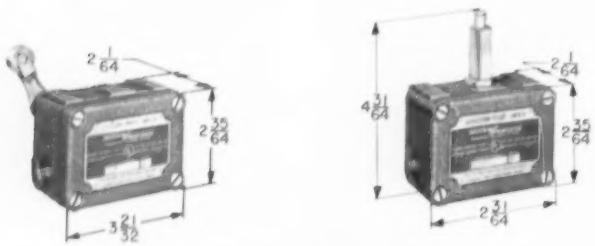
Machines shown are Cincinnati's new 16" Sliding Head Drill and 15" Tray-Top Lathe.

MICRO *precision switches*

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN



MICRO SWITCH heavy duty explosion-proof switches. Roller arm actuated (left), plunger-actuated (center) and roller plunger-actuated (right).



Explosion-proof switches with wide variety of mounting arrangements. Roller arm-actuated (left), plunger-actuated (right).

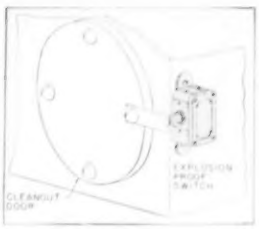
These reliable switches are insurance against many types of plant fires and explosions

MICRO explosion-proof switches are ideal electrical controls in flammable areas. They combine the ability to operate safely in explosive gas or vapor-air atmospheres with the desirable features of precise operation, accurate repeatability, small size, easy adjustment and durable construction. They are the most compact explosion-proof switches available.

MICRO explosion-proof switches are widely used in such hazardous atmospheres as those found in chemical plants, refineries, flour mills, coal mines and metal processing plants. They are Underwriters' Listed as suitable for use in hazardous locations Class I, Group C (atmospheres containing ethyl-ether vapor) and D (atmospheres containing gasoline, petroleum naphtha, alcohols, acetone, lacquer solvent vapors and natural gas); Class II, Group E (metal dust), Group F (carbon black, coal or coke dust) and Group G (grain dust).

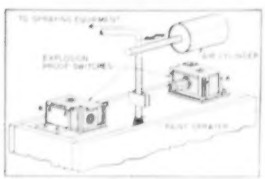
These switches are ideal components for installation on present plant equipment to make it safer, more automatic and more productive. MICRO precision switches are sold by distributors in key cities everywhere. Look under "Switches, Electric" in the yellow pages of your phone book.

As Incinerator Safety Interlock



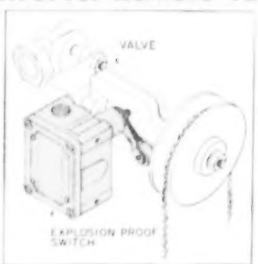
A snap-action explosion-proof switch on an oil or gas-fired incinerator prevents ignition of the fuel while the unit is being cleaned or repaired. The switch is held operated when the door is closed. Opening the door releases the switch actuator which prevents starting the ignition transformer.

Controls Automatic Paint Sprayer



Two switches speed up painting of parts and automatically shut off the spray gun at the end of each operation. When arm leaves the air cylinder, Switch "A" is released, starting the spray gun. Contact with Switch "B" turns off the spray. The painted part is removed and the operations repeated.

Control for Remote Valve



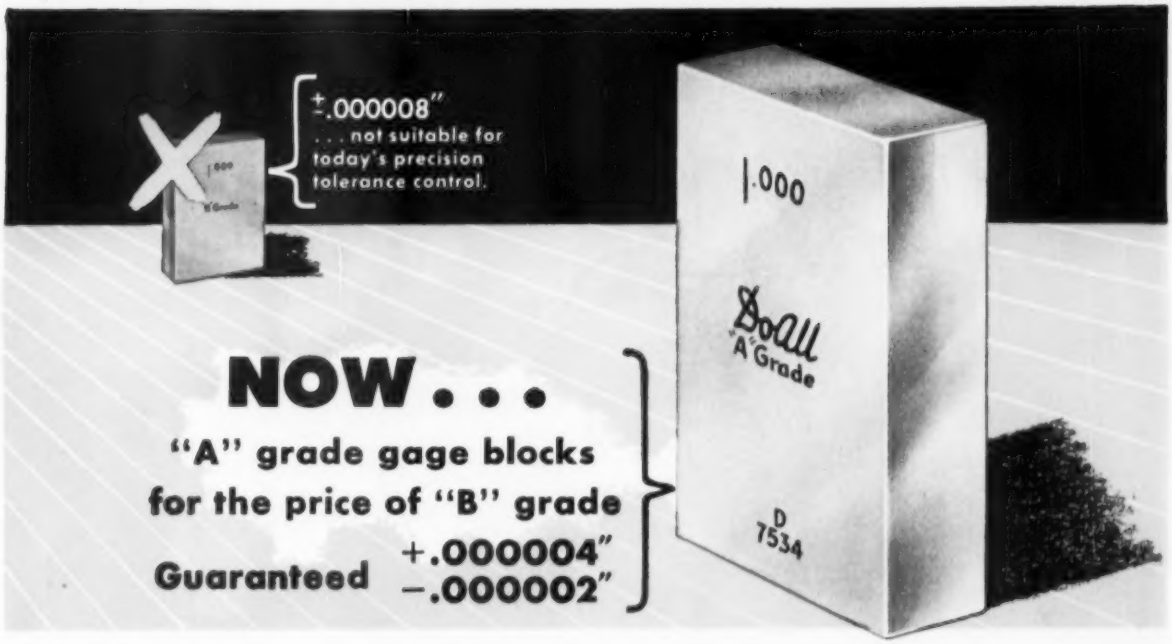
Explosion-proof switch notifies operator of the position of the disc in a remotely located valve. The valve, which contains a flammable liquid, is controlled from the floor below by means of a chain-operated wheel. The roller arm actuator is operated by the rim of the chain wheel. It is wired to a set of panel lights which indicate the disc position of the valve.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

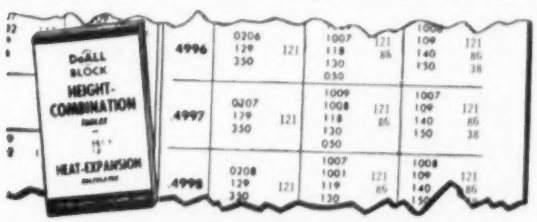
In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

Why "B" Grade Gage Blocks Cannot Meet Today's Needs...



Here is Why: Consider .0001", a common part tolerance today. The checking gage must be accurate to .000010"—equal to or better than the accuracy of many gage blocks in common use! For example, a new one-inch gage block is acceptable as grade "B" if accurate to ± .000011", including observational errors. A single two-inch block could have a permissible error of ± .000020", amounting to 20% of the .0001" tolerance.

Such inaccuracies may be greatly multiplied when a stack of blocks is used. For example, in checking a shaft



dimension of 2.4977 (± .0001") a minimum of five blocks from an 86 piece set would be required. Assuming the most favorable combination—one two-inch block and four others—the stack *could* vary plus or minus .000064" (over a half-tenth). This is more than half the allowable tolerance of the part itself! If some of the individual blocks were plus and some minus, the total error would be less—but how much less?

When dealing with critical tolerances, "B" grade blocks just aren't adequate. Contrast them with DoALL "A" Grade Blocks *now available for the price of "B" Grade.*

New DoALL "A" grade standards are plus .000004", minus .000002" maximum error per inch of length. Surface finish is guaranteed 0 to 0.09 RMS microinches, permitting calibration to within tenths of a millionth of exact size. Here is working accuracy you can rely upon —accuracy that eliminates need for calculating calibrated sizes, prevents errors, saves time and money. Why have less? Get the facts about DoALL's new gage block standards that meet today's needs. Remember, DoALL offers "A" Grade Gage Blocks at "B" grade prices.

Ask for Catalog—Call your local DoALL Store, or write

THE DoALL COMPANY

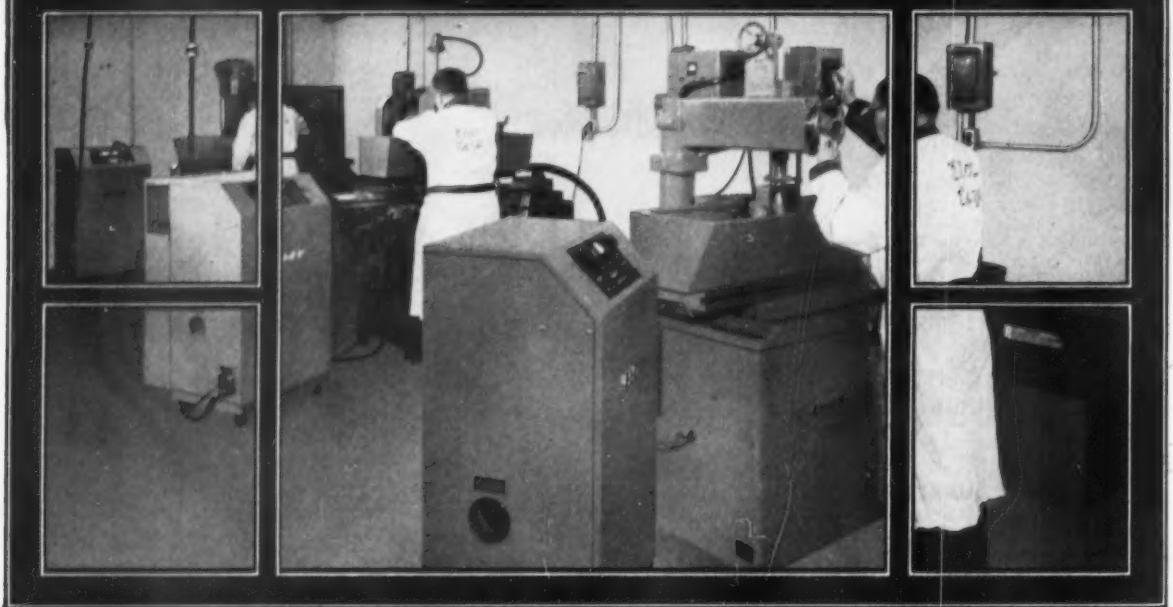
Des Plaines, Illinois

FREE — "How To Be Your Own Bureau of Standards" — tells how to inspect and calibrate gage blocks in your own shop. The only manual of its kind. Your copy free on request.

FRIENDLY DoALL STORES IN 38 CITIES give you personalized service and local delivery from complete stocks.

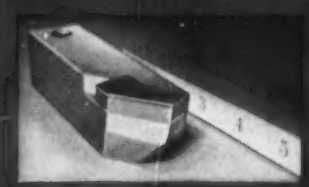
a room with a view

TO THE FUTURE



This is the Elox "Demo Room". The demonstration center where we prove that the machining of jobs formerly difficult or impossible can be done with ease and economy by Electrical Discharge Machining.

This "proof division" at Elox will run not just a few samples for you but enough quantity production to provide a real evaluation of how Elox E.D.M. can save time and money in your plant. Tungsten carbide tipped single point tools, forging dies, die casting dies and tungsten carbide form tools will be machined at a cost we guarantee cannot be duplicated by any other method. Make use of our Elox "Demo Room". It has proven to hundreds of plant execs that these jobs can be done better, faster, less expensively.



WE SAVED 19 MINUTES grinding this single point tungsten carbide tip boring tool.

WE SAVED 16 HOURS on 9 different operations on this form grinding of a carbide broach.

WE SAVED 379 HOURS on the machining of this die casting die.

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PREMIUM QUALITY SLEEVES, SOCKETS
now even better!

New "keyhole-type" drift slot eliminates the need for hammering on conventional drift and speeds tool ejection.

These benefits . . .	for these reasons	. . . result from these PREMIUM features
INCREASED ACCURACY	Run true in the machine spindle	1. Precision-finished to high degree of concentricity.
		2. Hardened surfaces resist nicking and burring.
INCREASED PRODUCTION	Faster tool changes	3. Properly hardened and precision-ground surfaces assure perfect fit in spindle.
	Guard against cutting tool breakage	4. New "keyhole-type" drift slot simplifies ejection of chucks and tools—eliminates pounding.
	Longer tool life	5. Outlast several soft sleeves or sockets—proper steel and hardness prevent twisting, nicking, and spindle damage.
REDUCED TOOL COSTS	Adapt your present machines and cutting tools for wide range of operations	6. Convert any Morse Taper hole and shank to a smaller or larger taper.
		7. Three series of sockets and turret tool holders extend spindles and turrets to reach otherwise inaccessible machining locations.

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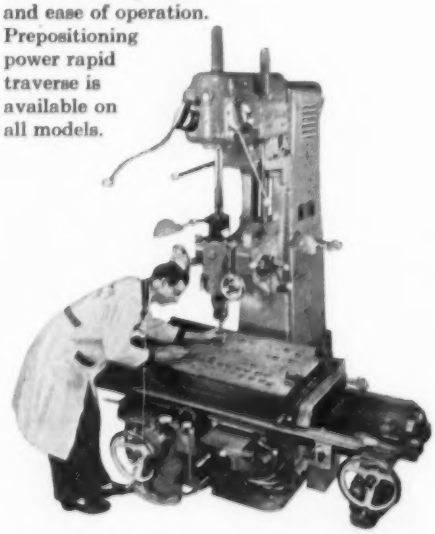
Unexcelled precision for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work and on "jigless" production. Combines stamina with precision and ease of operation. Prepositioning power rapid traverse is available on all models.



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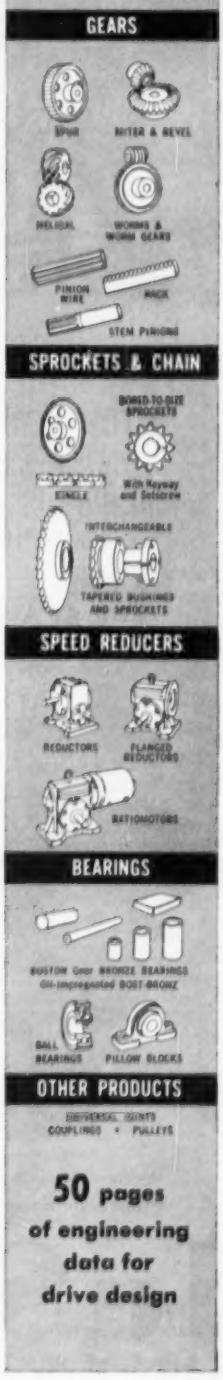

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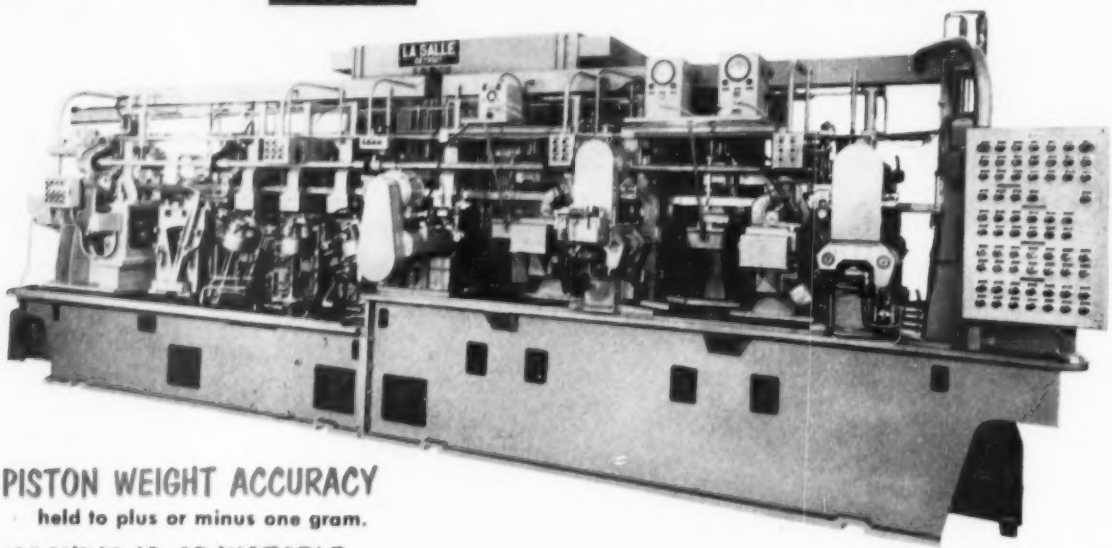
La Salle AUTOMATED PISTON LINE

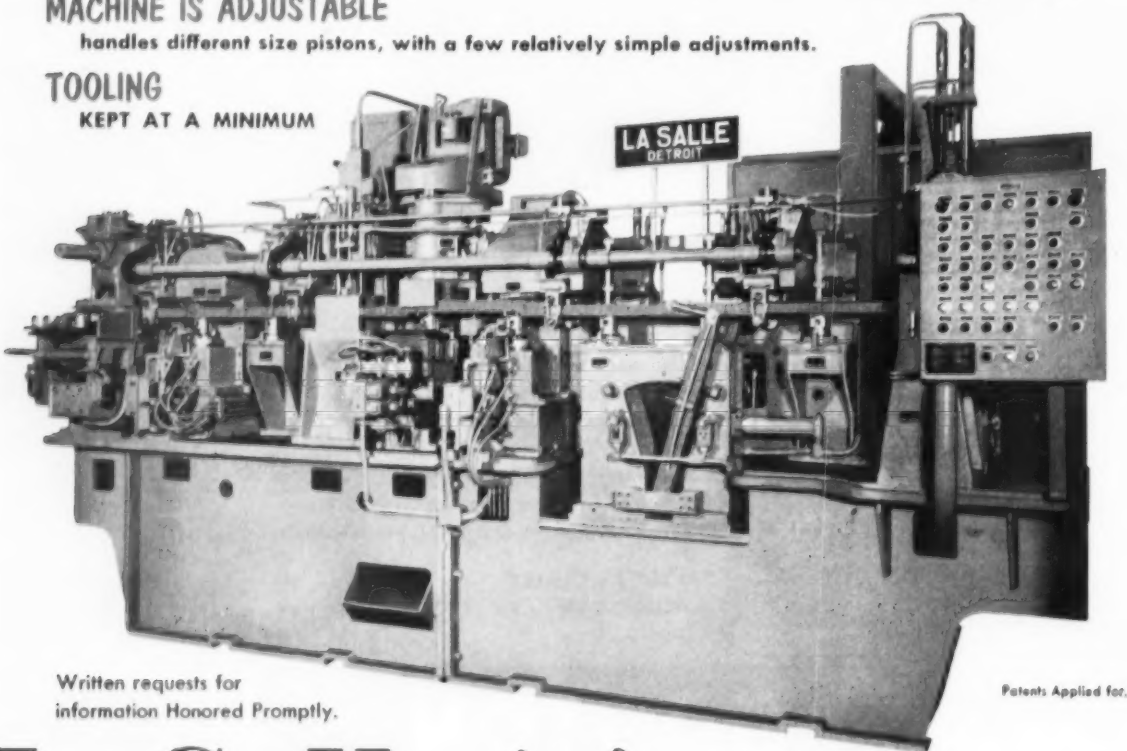
PRODUCES 400 PISTONS PER HOUR



PISTON WEIGHT ACCURACY
held to plus or minus one gram.

MACHINE IS ADJUSTABLE
handles different size pistons, with a few relatively simple adjustments.

TOOLING
KEPT AT A MINIMUM



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Patents Applied for.

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OUTSTANDING PERFORMANCE

50,000 couplings per Bath Tap!

Bath Taps in action at Wheatland Steel.

Bath engineers helped to solve a tough tapping operation for Wheatland Steel Products Co., Wheatland, Pa. — large manufacturers of steel pipe and pipe couplings.

Tapping these couplings is a difficult job because it is not only necessary to tap a full 100% thread form, but in addition to tapping, the tap must ream out the excessive material in the rough bore of the pipe coupling.

Extra rigid inspection is maintained by Wheatland as the thread form must be "just so". In addition to size requirements, threads must be smooth and round to make a pressure-tight joint when assembled.

An average performance for these Bath Straight Pipe Coupling taps is the threading of over 50,000 couplings with a minimum number of sharpenings per tap — adequate proof of another Bath tap job well done!

Un-retouched photograph of special 1½-11½ Bath Steam Coupling tap after threading 50,000 couplings.

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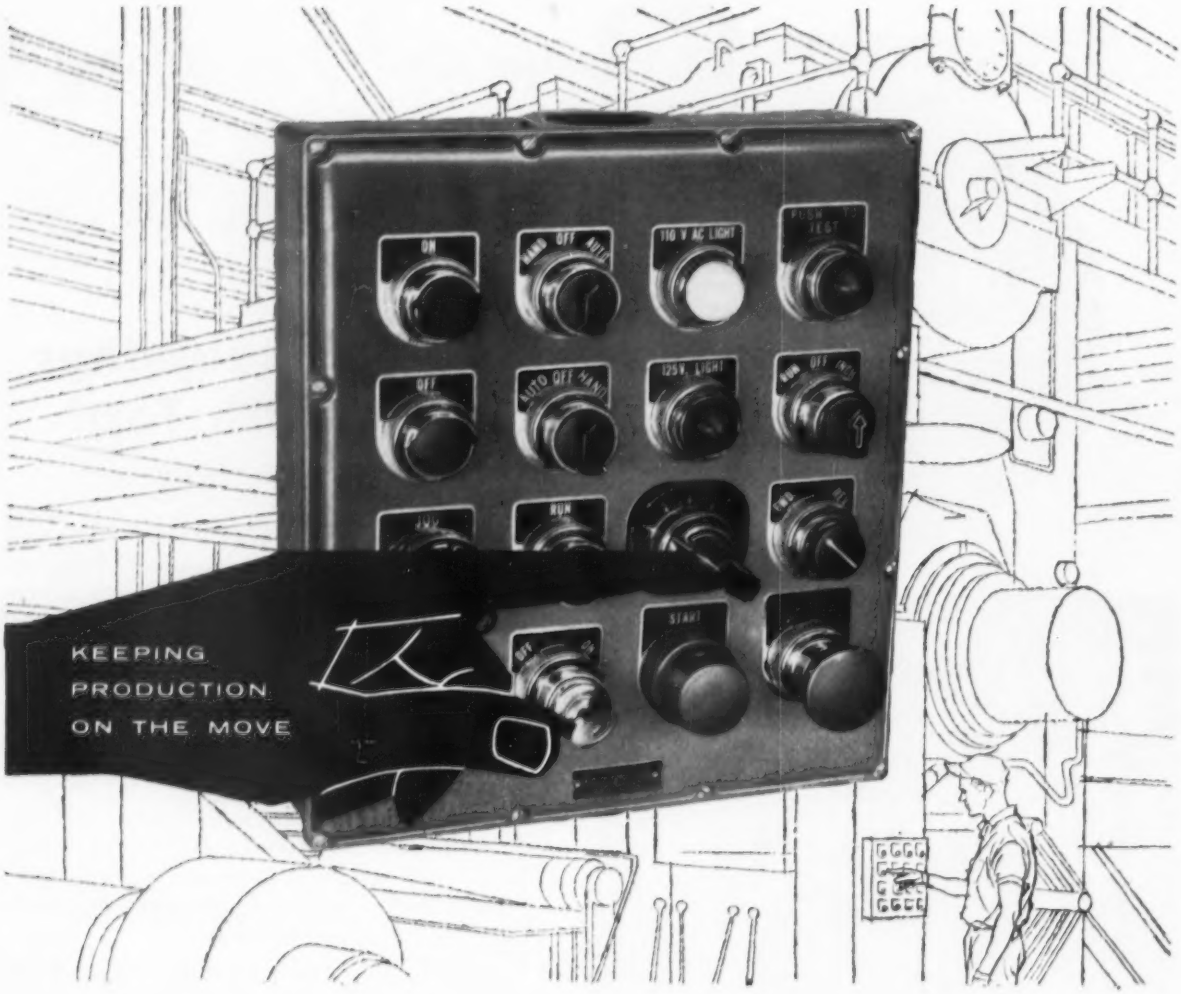
CYLINDRICAL AND THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS



. . . with Westinghouse Oil-Tite control stations—1 to 16 units

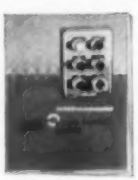
Interchangeable parts — stations, contact blocks, operators and indicating lights — right off the shelf, quickly give you a "tailor-made" Westinghouse Oil-Tite* control station to meet the requirements of any heavy-duty industrial equipment application.

Enclosures — die-cast and Bonderized — include cork-neoprene gasketing and close machine fits as positive seals against exposure to oil, coolants, cutting compounds, water and other foreign matter.

*Trade-Mark

New Pushbutton Guide

For more facts on why it will pay you to standardize with Westinghouse control stations, get a free copy of the new *Pushbutton Guide*, booklet B-6749. See your nearby Westinghouse salesman or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30210



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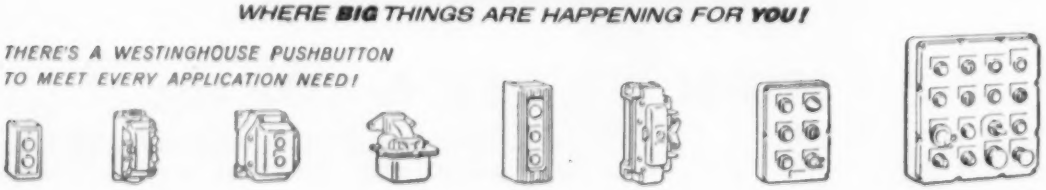


POWELL *flow-matic** Slashes Handling Costs for Leading Automotive Parts Manufacturer

Executives of the Eaton Manufacturing Company's Saginaw, Mich., plant became concerned over the costs of handling materials during manufacture. They decided a thorough study of modern equipment currently available was in order. Their decision: Flow-matic* by Powell—a highly flexible system of automatic feed hoppers and boxes that enables users the greatest cost reductions on a plant-wide variety of operations.

BEFORE

Parts were handled in small quantities in tote pans. This meant the machine operator was constantly lifting and carrying. Weights had to be kept light to prevent injury to the operator. The pans were then stacked on pallets requiring lift truck handling. Warehousing and inventory were slow, tedious jobs.

AFTER

Same lift trucks were utilized. Instead of the dozens of small pans, each individual operation was consolidated with but a single hopper stand. The hopper put the work right at the machine—no lifting or carrying. Production benefited. Floor area became neater, more efficient. Warehouse area was reduced considerably.

When lift truck operator sets Flow-Matic* box on stand it automatically opens, discharging contents into "right-level" work hopper. The system is easily adaptable to a wide variety of jobs.

Remember handling adds nothing to the value of your product. Unnecessary handling increases your costs, weakens your competitive position. Make sure you have the most efficient handling possible. If you honestly compare—we're sure you, too, will specify Flow-matic* for your handling reuirements.

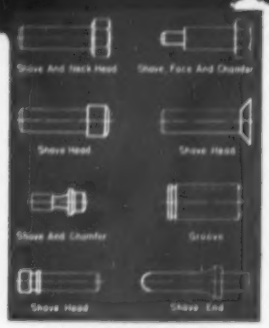
*TM Powell Pressed Steel Co.

POWELL PRESSED STEEL

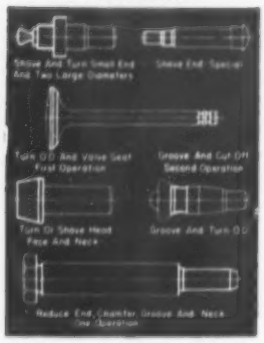
THE POWELL PRESSED STEEL CO.

DEPT. 976 HUBBARD, OHIO

ECONOMY Automatic Shaving Machines
FOR LOW COST, FULLY AUTOMATIC—HIGH PRODUCTION



Typical parts machined on the "LS"-3600


Shave And Turn Small End And Two Large Diameters
Shave End Special
Turn O.D. And Valve Seat First Operation
Groove And Cut Off Second Operation
Turn O. Shave Head Face And Neck
Groove And Turn O.D.
Reduce End, Chamfer Groove And Neck One Operation

Illustrating operations completed on the S-4300

THE ECONOMY LINE

Automatic Shaving Machines
Automatic Pointing Machines
Semi-automatic Pointing Machines
Automatic Pointing & Threading Machines
Automatic Pointing & Shaving Machines
Double End Automatic Pointing Machines

ECONOMY Automatic Shaving Machines are designed to perform facing, turning, grooving, necking, cut-off and burnishing operations on bolts, automotive valves, projectiles and similar parts.

They are available in two sizes—the "LS"-3600 for body diameters up to 1/2" and lengths under heads from 1/2" through 4-1/2"—the S-4300 for body diameters up to 1" and lengths 3/4" to 6" under heads. Production rates for the standard "LS"-3600 range from 800 to 2400 finished parts per hour and the S-4300 from 450 to 1800 per hour.

Machines are fully automatic and parts flow from hopper to work pan. Simple adjustments plus easy, rapid set-ups enable operator to operate several machines.

For the ultimate in accuracy, high production and low costs investigate ECONOMY Automatic Shaving Machines.

THE ECONOMY ENGINEERING CO.
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Designers and Manufacturers of Secondary Operation Machines since 1915

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The standardized series of Yoder Uncoilers, Slitters and Recoilers make possible an infinite number of combinations for highly efficient coil and sheet slitting.

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A Yoder standardized slitting line is a most profitable production tool which will pay for itself in short order on strip requirements as low as 100 tons per month, even less. Equally important is the ability in a few hours to meet expected and unexpected needs for slit strands, from a relatively small stock of standard width coils. This greatly reduces strip inventories and simplifies production planning.

The Yoder Slitter Book contains time studies, production records, and other valuable data on the economics as well as mechanics of slitter operation. A copy is yours for the asking; also estimates and recommendations.

THE YODER COMPANY
5519 Walworth Ave., Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING
SLITTING LINES

THE POWELL PRESSED STEEL CO.
DEPT. 976 HUBBARD, OHIO

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Industrial safety is as vital to Johnson Motors as the production of fine outboard motors. The fire hazard that die-casting equipment ordinarily creates has been controlled at Johnson through the use of fire-resistant Pydraul hydraulic fluid.

FIRE-RESISTANT PYDRAUL F-9
CHANGES FIRE ZONES TO SAFETY ZONES

275 million hours of actual in-use operation—without a single hydraulic fire—*proves* the safety and dependability of fire-resistant Pydraul hydraulic fluid.

But Pydraul gives you more than safety. You can be sure of long equipment life with low maintenance . . . because Pydraul lubricates like a premium petroleum oil. You'll save money on fluid consumption, too! Pydraul is reclaimable—you can return spillage to the system, use it again and again.

Make a quick check of your hydraulic equipment . . . calculate your fire risk if it's close to hot metal, electrical contacts, open flame or other heat sources. Then talk to a Monsanto representative. He will show you how easy it is to convert to Pydraul . . . giving you a future of positive safety from hydraulic fires . . . at low cost per year.

PYDRAUL MEANS:

Fire Resistance
Excellent Lubricity
High Stability
No Corrosion
Re-use, Again and Again

Write now for new booklet, "PYDRAUL F-9." Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. PYD-2, St. Louis, 1, Mo.

PYDRAUL F-9—First and Only Hydraulic Fluid Listed by Underwriters' Lab.

On May 31, 1955, Pydraul F-9 became the first fire-resistant hydraulic fluid listed by Underwriters' Laboratories. From the Laboratories' Service Card: "The fire hazard of (PYDRAUL) is rated 2 to 3 in accordance with Underwriters' Laboratories, Inc.'s Standard of Classification in which Ether rates 100, Gasoline rates 90-100, Alcohol (ethyl) rates 60-70, Kerosene (100° F. flash) rates 30-40, and Paraffin oil rates 10-20." See Underwriters' Laboratories, Inc.'s guide No. 540 18, File MH6049.

PYDRAUL: Reg. U. S. Pat. Off.

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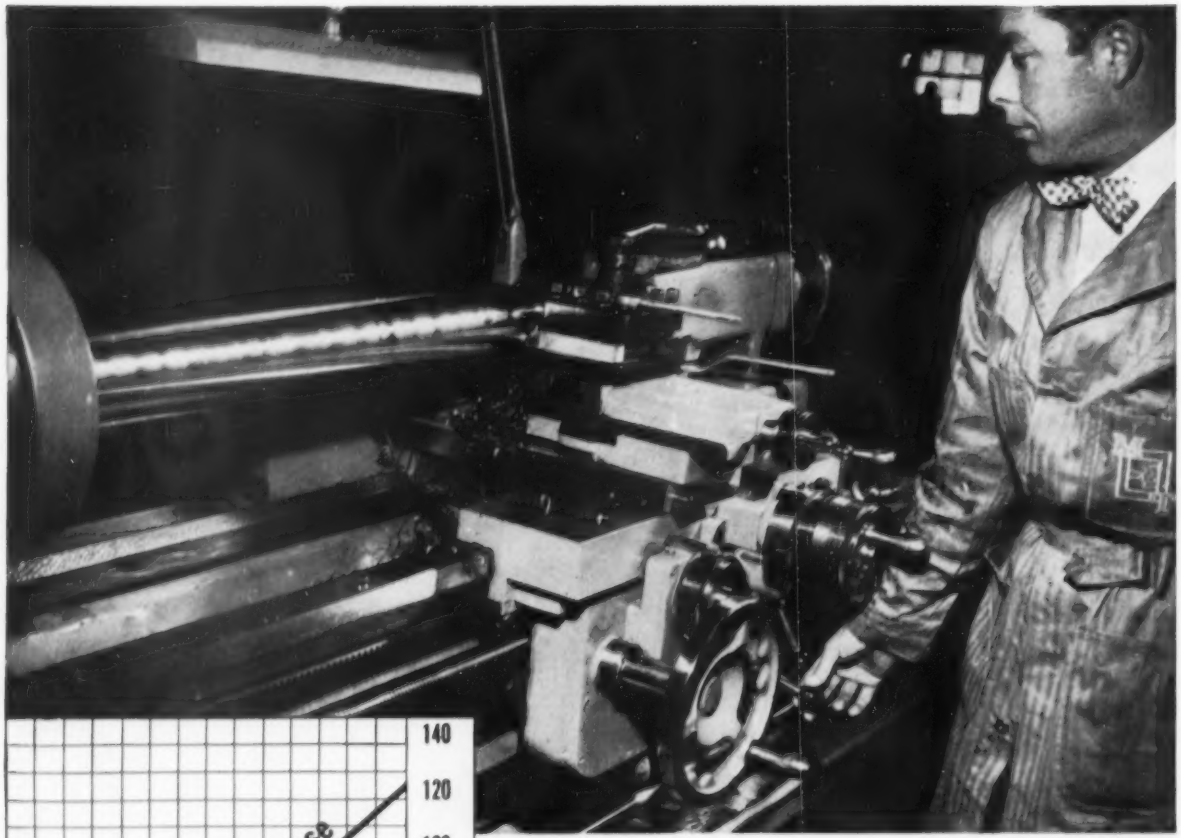
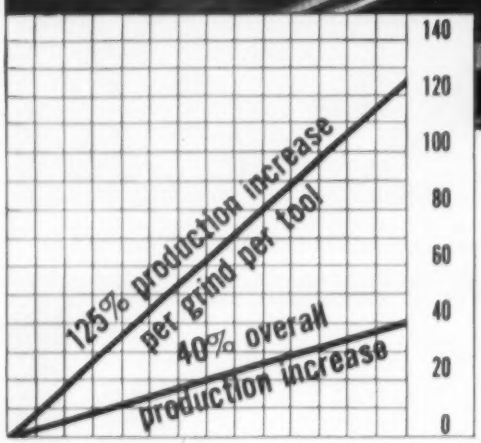
WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU





Lathe Shaft production *UP 40%* with new Firthite TXH Carbide

Wherever used, *new* FIRTHITE TXH Carbide is proving its competitive superiority . . . as at Boyé & Emmes Machine Tool Company, Cincinnati, for turning lathe shafts from 3 inch SAE 4140 un-annealed steel.

Here's what they found:

- Overall production went up 40%.
- Production increase of 125% per grind per tool.
- Twelve shafts per tool without regrinding.
- Only .0010 flank wear in 12 cuts.

Impressive? You bet! So much so that many tool engineers have acclaimed TXH as the most nearly "universal" grade of carbide yet developed. That's because TXH is an entirely new concept in carbide metallurgy . . . a combination of materials and processes designed specifically to do heavy-duty, high-production cutting operations better than they have ever been done before. And while a distinctly *premium grade,* TXH is not *premium priced!*

You try it. It's available from stock in all standard tips, tools and inserts.

TXH ADVANTAGES

- Higher hardness to strength ratio
- Improved impact resistance
- Wider range of applications
- Lower operating temperatures
- Higher edge strength
- Greater resistance to abrasion

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON
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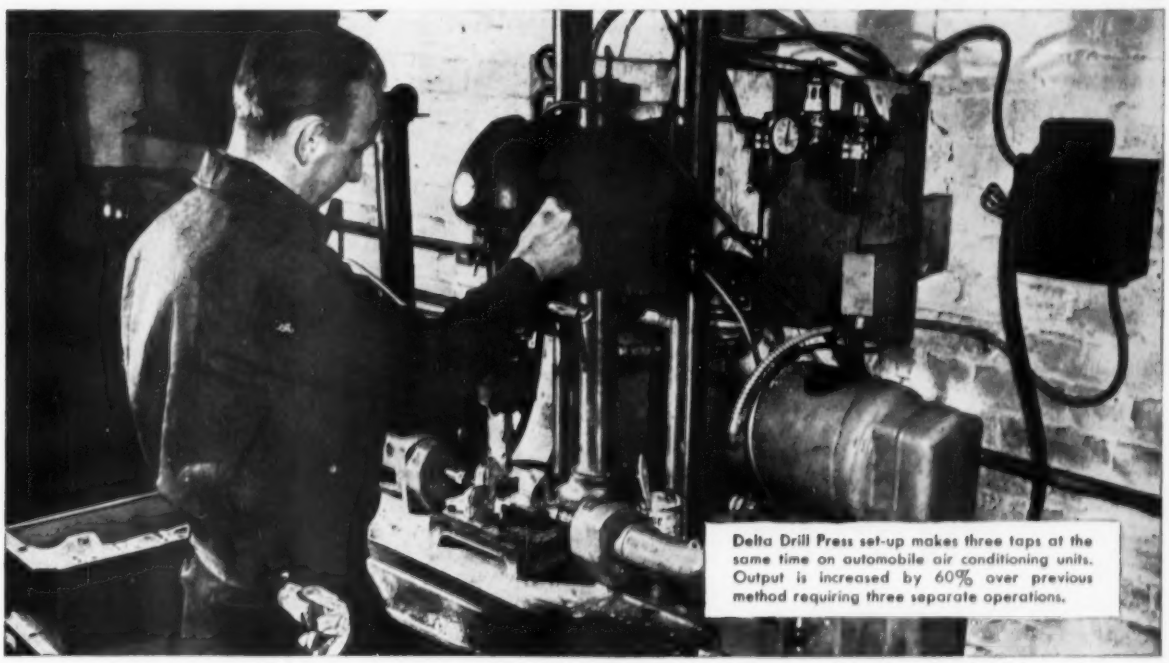
ROCKWELL-BUILT

DELTA drill presses

eliminate need for expensive custom tooling

at Sterling Die Casting Co., Brooklyn, N. Y.



Delta Drill Press set-up makes three taps at the same time on automobile air conditioning units. Output is increased by 60% over previous method requiring three separate operations.

MULTIPLE SET-UPS INCREASE OUTPUT—The fact that Delta Drill Presses can be adapted to handle multiple operations quickly and efficiently enables Sterling to use them on jobs normally requiring larger, costlier equipment—boosting output by as much as 60%.

MORE THAN PAY FOR THEMSELVES—According to Walter Pullman, shop foreman, there are two reasons why: first, they cost much less to buy and operate than custom-built tools; and second, they do more work faster, at less cost.

NO TROUBLE IN 15 YEARS—Many of the 14 Delta Drill Presses at Sterling have been in constant use for over 15 years. In all this time, according to Mr. Pullman, they've really taken a beating yet still provide dependable operation with minimum maintenance.

SEE THE COMPLETE DELTA DRILL PRESS LINE

14", 14" Super-Hi Sensitive, 17"—over 100 models in floor, bench and multiple spindle set-ups. Get all the facts and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the yellow pages.

Send The Coupon For All The Facts!

DELTA ROCKWELL

another product by **ROCKWELL**

Delta Power Tool Division, Rockwell Manufacturing Co.
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- ☐ Please send catalog on complete Delta Drill Press line.
- ☐ Please send Fact Book on using Delta Power Tools teamed with Machine Tools.
- ☐ Please send name of my nearest Delta Dealer.

Name_____ Title_____

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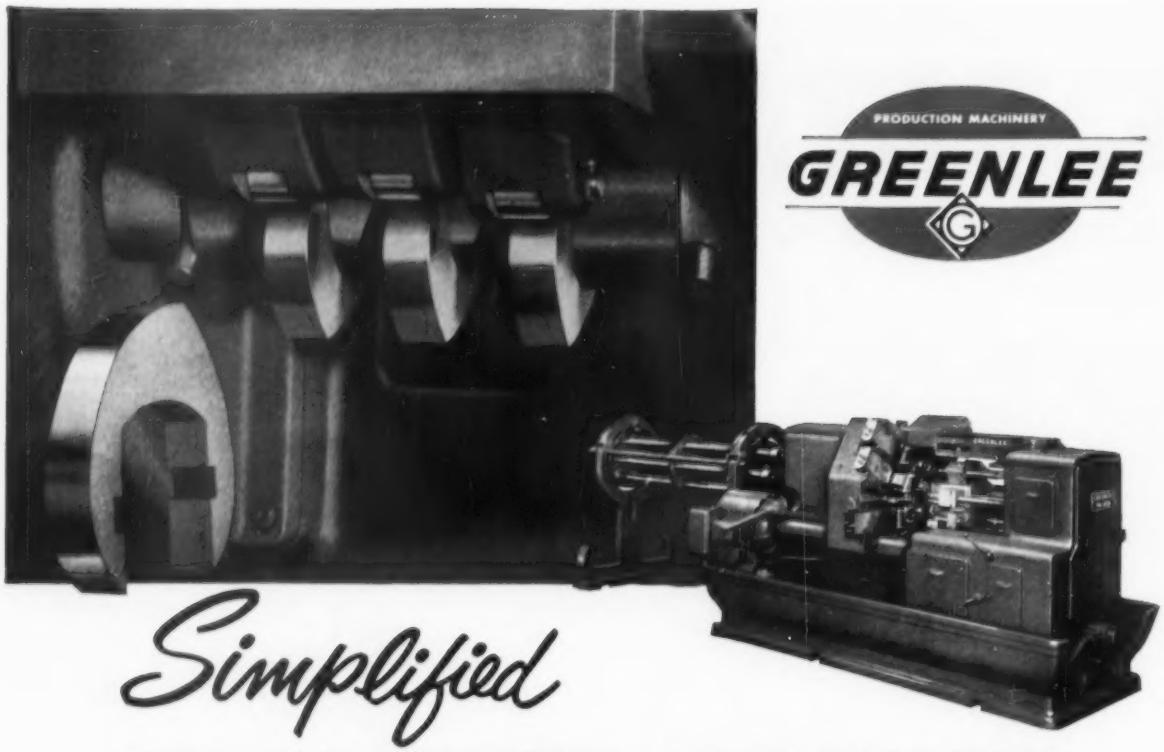

PRODUCTION MACHINERY

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Simplified CROSS-SLIDE CAMMING

ON GREENLEE BAR AUTOMATICS

Gives You Greater Flexibility... Saves Setup Time

CAMS ARE INTERCHANGEABLE

CAMS ARE SMALL, EASY TO HANDLE

CAMS HAVE UNIFORM HIGH-POINT

Greenlee simplified camming results in simplified, fast setups. Operation is economical and efficient . . . especially so on short runs. Each cross slide operates independently by a separate cam . . . long operations are easily split up for greater flexibility and more effective use of machining time. On a Greenlee your investment in cams is held at a minimum . . . the same cams can be used on any cross slide. Greenlee engineers will be glad to show you how to reduce profit-stealing setup time on the simplified Greenlee. Take advantage of this valuable service now.

Do you receive a copy of the Greenlee "Automatic News" regularly? If not, write and ask to be placed on our mailing list. Give company name and job responsibility.

WRITE TODAY FOR CATALOG A-405

PRODUCTION MACHINERY

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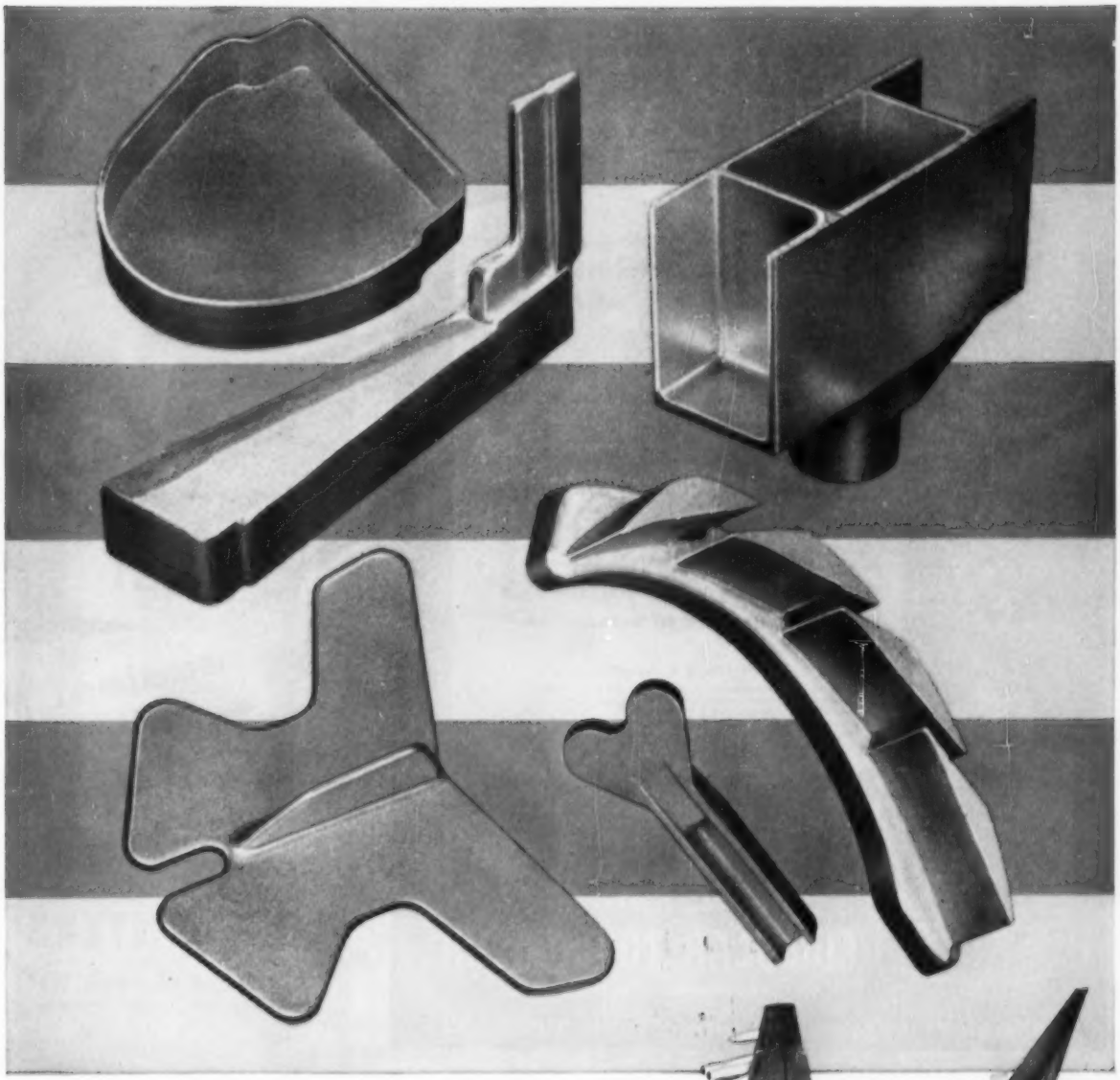

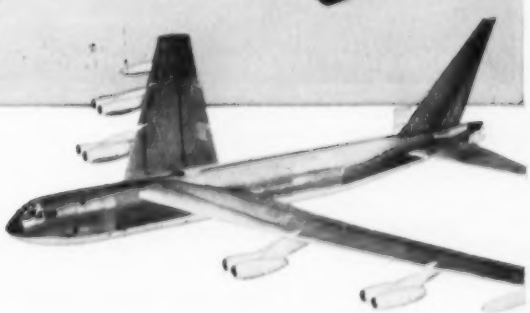

No-draft forgings by Kaiser Aluminum

KAISER ALUMINUM'S Erie plant has been successful in meeting its customers' ever-growing needs for no-draft forgings.

Shown on this page are a few of the many no-draft forgings produced by Kaiser Aluminum on *existing equipment* for the aircraft industry.

Additional equipment—especially designed for no-draft forgings—will soon be installed to greatly increase our capacity for these specialized forgings.

Kaiser Aluminum no-draft forgings give you the benefits of substantial cost savings through the elimination of machining, plus extremely light weight with high strength, close tolerances, and superior finish.

When you submit your aluminum forging inquiry to Kaiser Aluminum, our highly skilled engineering staff will evaluate the forging to determine its suitability as a no-draft forging.

For immediate service, call any Kaiser Aluminum sales office listed in your local telephone directory. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office,* Palmolive Building, Chicago 11, Illinois; *Executive Office,* Kaiser Building, Oakland 12, California.

Kaiser Aluminum

For control of cutting costs

... use CIRCOLOY *Saws*

Circoloy Saws do jobs too tough for HSS, not tough enough for carbide — enabling you to cut costs by restricting use of carbide and HSS to purposes they serve best. Circoloy, supplied exclusively by Circle R, widely outperforms HSS in terms of longer life, longer production runs, superior cutting. For less down time in automation or regular production, specify Circoloy Saws. See our Catalog N for details.

Circoloy assures the sustained precision performance indispensable to automation.

Consult CIRCLE R Specialists in —

Burbank	Hackensack	New York City	Pittsburgh
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METAL SLITTING SAWS
COPPER SLITTING SAWS
SCREW SLOTTING SAWS
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PROVIDENCE 5, RHODE ISLAND

Specialists in Circular Cutting Tools Since 1923

best for your jobs!

easiest to get!

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LIVE CENTERS

Guaranteed to match the accuracy of your lathes

IDEAL'S simplified ordering plan ends tool room headaches. Get exactly the live center you need when you need it — right from distributor stocks. Widest range of models, sizes and capacities — all precision-built for continuous close tolerances.

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Please send us data on IDEAL'S complete line of LIVE CENTERS.

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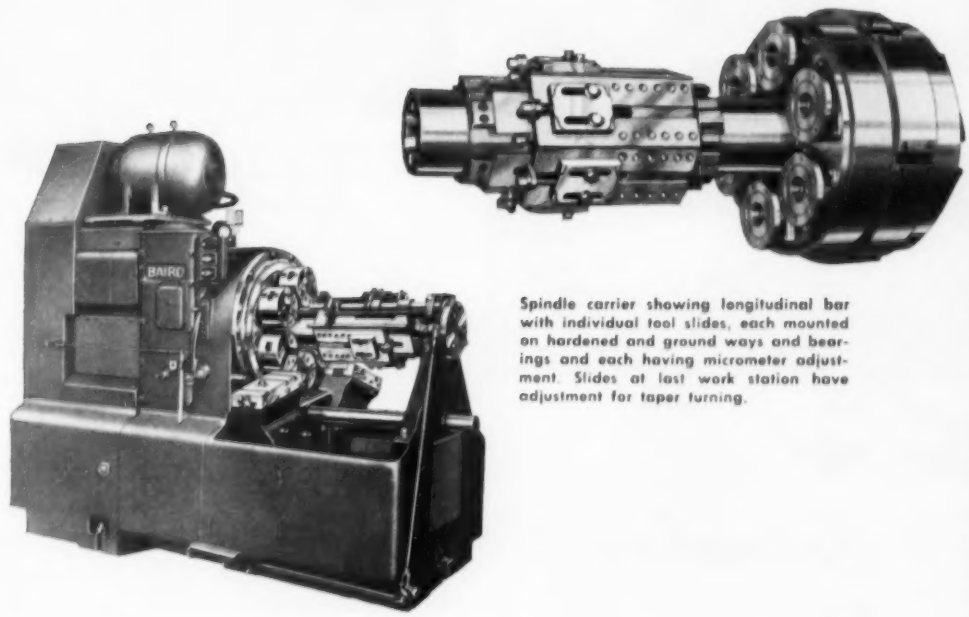
From the *American Machinist* Library of *Tips for Top Shop Men*

GET to know your people *before* you have to get tough with 'em. It's poor policy to make their acquaintance by bawling 'em out. Introduction by insult is no longer a successful management routine.

...ask BAIRD about it



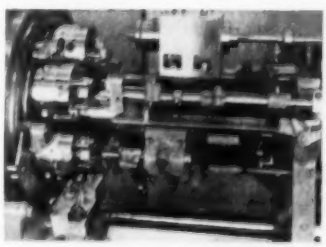
Spindle carrier showing longitudinal bar with individual tool slides, each mounted on hardened and ground ways and bearings and each having micrometer adjustment. Slides at last work station have adjustment for taper turning.

Why the preference for BAIRD Chuckers?

Aside from the fact that the Baird 76-H Chucker has enough outstanding design features and advantages to fill a 12-page brochure (which we will be glad to send you on request), there are two main reasons for its popularity.

One is the unique versatility in tooling provided by an essentially simple, "clean" design which at the same time permits exceptional scope in variety and sequence of operations and cycles . . . including complete automation.

The other is the manner in which Baird Engineering tackles an *individual* customer's problem. Here you get the benefit of our years of work with the nation's top high-production specialists . . . a staff of chucker experts, backed by exceptional tooling and test facilities. When a Baird Chucker reaches the production line, promised performance can be achieved . . . and manitained.



An example of versatile Baird 76-H Chucker tooling for finishing a die cast aluminum end plate, single-indexing, including recessing tool for back-facing . . . high speed boring heads, two-spindle lead screw tapping attachment. Production: 420 pieces per hour.

Our case history files almost certainly contain the start of a profitable answer to YOUR problem in high-speed repetitive production. Before you decide on methods or machines, it will pay you to "Ask Baird About It." Write Dept. AM.

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC ASSEMBLY MACHINES • SPECIAL MACHINES

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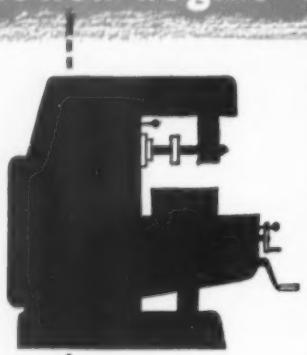
production begins with



Columbus Die-Tool

No tools like the right tools! Columbus Die-Tool designs and builds tools, jigs, fixtures and special machinery to meet your most exacting requirements. RESULTS: operating cost that matches your budget; production that matches your schedule; product quality that matches the demands of your market.

Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 50 years.

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AND MACHINE COMPANY
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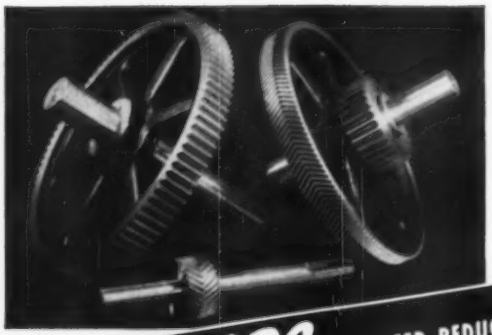
ESTABLISHED 1900
Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS



GEARS FOR SPEED REDUCERS

Illustrated are speed reducer assembly table gears for use in rolling mill machinery. Made right, of the finest materials, these gears give meaning to Stahl's long-standing reputation for producing gears to exact specification—economically and on time. Get Stahl's estimate first!

SPURS TO 72" PD, 1 DP
BEVELS TO 54" PD, 1 DP
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All sizes up to 14" capacity, with and without automatic stock feed
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END NIGHT CLEANUP & MORNING REBLUING
DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.
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Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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Hundreds of "*Special*" Electrodes

are Standard MALLORY Designs...

And Cost Less!

Just about any resistance welding electrode you may require . . . straight, bent, long, short, irregular . . . you can find in the extensive family of Mallory designs.

There is an almost unlimited selection of Mallory Standard Electrodes which can be made up promptly from existing designs, using available tools. This group includes single-bend and double-bend types which are produced by exclusive Mallory techniques to develop maximum strength and hardness . . . with fluted cooling holes and cooling tubes bent in place.* Also available are many odd shapes for welding in corners, inside channels and in other hard-to-reach spots.

Chances are you can get electrodes from Mallory which fit your application exactly . . . with prompt delivery . . . at a price that provides substantial savings over custom-made designs. All are made to highest standards of precision workmanship, using alloys and methods developed during Mallory's quarter century of leadership in the resistance welding field.

Write today for a copy of the latest Mallory Resistance Welding Catalog listing the complete line of electrodes, holders, seam welding wheels, dies, forgings and castings . . . or get one from your local Mallory welding distributor.

*Patent No. 2,489,993

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario.

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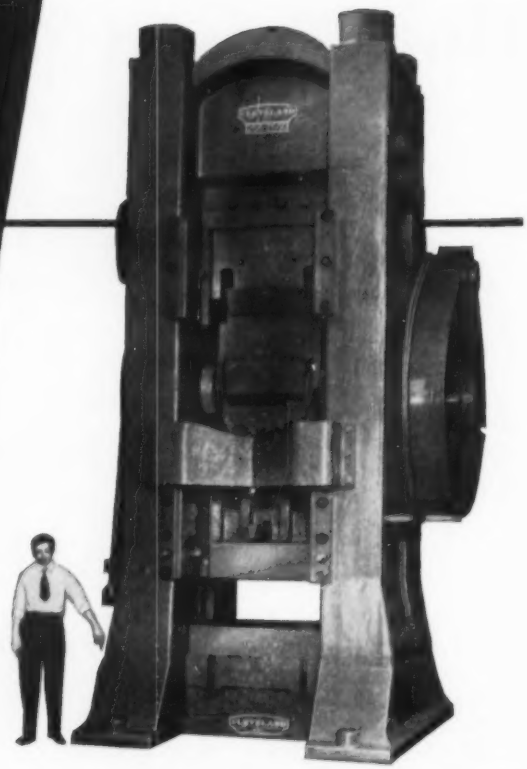
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

250 TONS OR 2500 TONS

Large or small . . .
your stampings cost less
with a
CLEVELAND PRESS!

Cleveland S1-250-36-42 Straight Sided Single Point Press 250 tons capacity



Cleveland 25K Knuckle Joint Press 2500 tons capacity

Each of the 11 specialized types of Cleveland Presses is made in a wide range of sizes. You're sure of getting the exact press to give you utmost production economy.

The construction of all Clevelands is simple and powerful featuring ease of adjustment, minimum wear of moving parts, economy of operation and production accuracy.

You'll find that our patented Cleveland Clutch minimizes costly down-time. It gives you positive, fast control of the slide during all phases of operation. This reduces stamping rejects. What's more its light-weight design requires less horsepower for operation.

Extremely long slide bearing surfaces and rugged frame construction eliminate slide deflection even under maximum load.

These important Cleveland features assure you of lower unit stamping costs. Before you buy your next press won't you let us give you the complete Cleveland story? Just write or call today!

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Established 1880

POWER PRESSES – FABRICATING TOOLS

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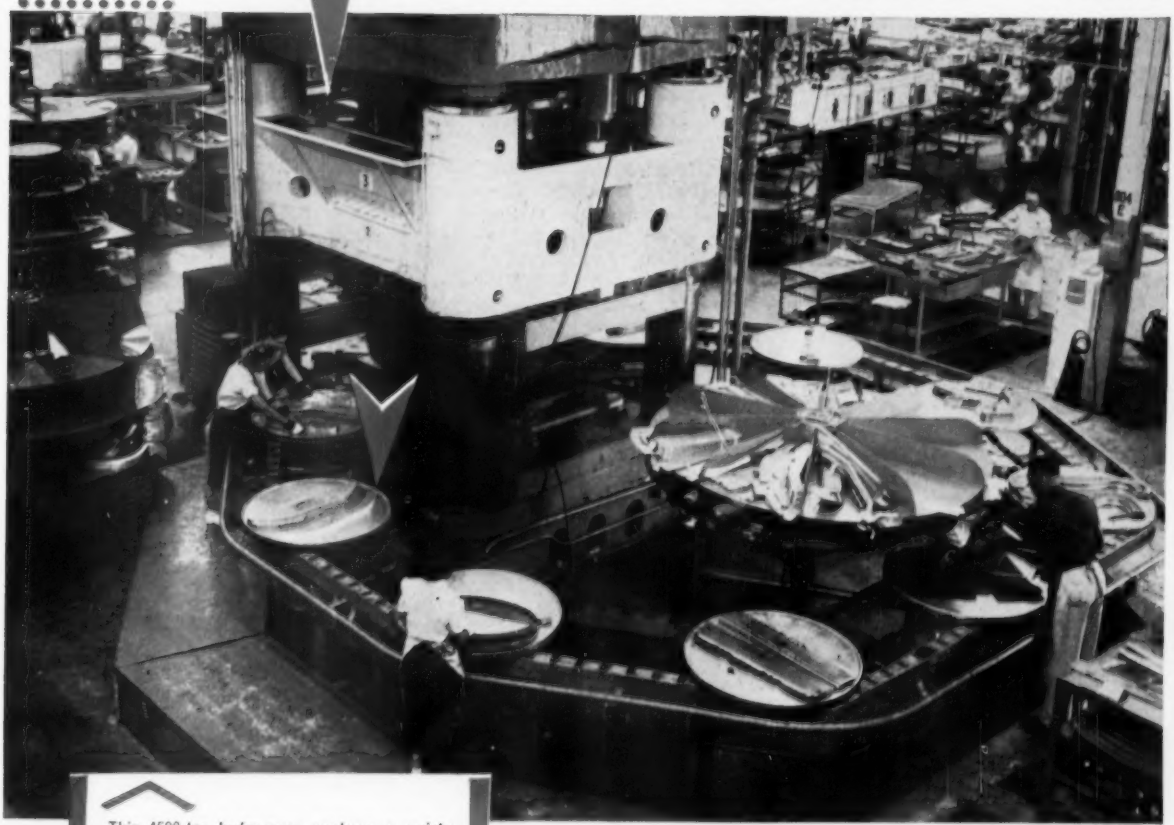
CITY FOUNDRY DIVISION · SMALL TOOL DEPARTMENT

FAWICK-EQUIPPED "MERRY-GO-ROUND" TRIPLES PRODUCTION OF PRECISION AIRCRAFT PARTS



This 4500-ton hydro-press produces a variety of aircraft parts at the Los Angeles plant of North American Aviation, Inc. Synchronized with the press is a "merry-go-round" shuttle table, equipped with Fawick Clutch and Brake, which tripled the efficiency of the operation. The shuttle transfers platens from standby to forming position in 5 seconds—complete cycle takes 19 seconds. Labor has been cut 50% and a former safety hazard has been 80% eliminated.

DRIVE UNIT uses Fawick Clutch and Brake because of smooth starts and stops and adaptability to sequencing without undue maintenance costs.

Smooth starting and stopping . . . instant response to controls . . . low maintenance cost—these are the reasons why North American Aviation, Inc., selected a FAWICK Airflex Clutch and Brake for the drive unit of their own design "merry-go-round" shuttle table. This new device has tripled production of precision aircraft parts from a 4500-ton hydro-press.

This is another example of the outstanding performance of FAWICK Products in many industries. For more information on how FAWICK can improve the performance of your machines, call or write your nearest FAWICK Representative or the Home Office today.

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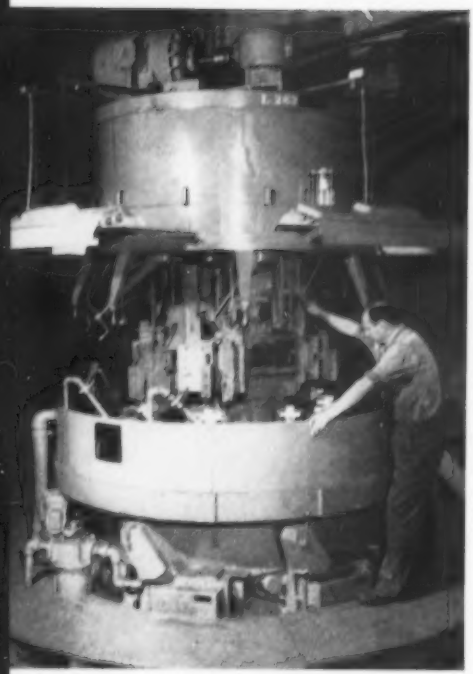


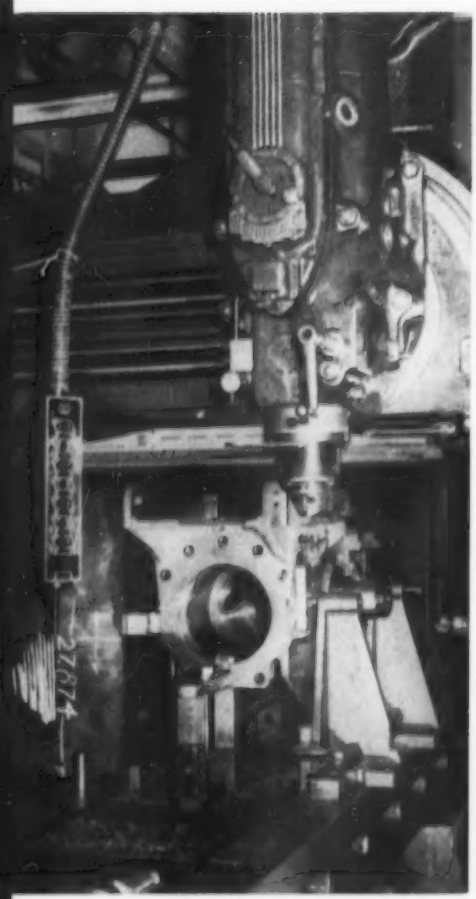
Tough Machining and

. . . see Sections B and C and Buyer's Guide Issue

NEW YORK—Subscribers with machining and tooling problems will find "Production Nuggets"—the essence of production ideas published in American Machinist throughout the year—in Sections B and C of American Machinist's 1957 Production Planbook and Buyer's Guide Issue due to be mailed Mid-November, 1956. Each "Production Nugget" summarizes one idea from a previously published article, with issue date and page number for subscribers who want more specific details with drawings, diagrams and illustrations.

Subject matter in Section B will cover articles related to machining ideas—metal removal techniques and production equipment required, such as planing, milling, turning, grinding, and drilling; automation devices and methods reported during 1956; cutting fluid and coolant developments; grinding wheels; and other adjuncts to metal removal. For example:

Grinding speed for titanium is extremely critical. For a given alloy and a given cutting fluid, there will be one speed at which minimum wheel wear is experienced. For surface grinding, speed may be 1500 sfpm, table feed of 400 to 500 ipm, downfeed 0.001 in. per pass, crossfeed 0.05 in. For internal grinding,



Tooling Problems?

in AM's 1957 Production Planbook for new ideas and techniques...

wheel speed should be below 1800 sfpm, work speed 40 sfpm, feed 0.002 in. AM—Aug 15 '55, p97

Small lots, as few as 10 pieces, can often be handled to advantage on copying lathes. Change-over time is short because there is usually only one templet and one tool to change, higher speeds are possible because a single-point tool produces less vibration than multiple-tool setups, and secondary finishing operations can be reduced or eliminated. AM—Sept 12 '55, p138

Section C's "Production Nuggets" will deal with tooling—the cutting tools, jigs, fixtures, dies, holding devices and press tools required for metal removal and metal forming production operations, such as:

Inert-gas atmosphere for welding titanium is maintained by performing work in a steel box built on the table of a welding positioner. Operator works with rubber gloves sealed to chamber walls, views work through windows of ultra-violet-absorbing acrylic sheet plastic. Gas lock permits introducting work and tools without breaking seals. AM—Aug 15 '55, p102

Swivel grinding fixture permits grinding both angles and nose radius on carbide boring bits in a single setup. Grinder has two diamond wheels, the finisher being set 0.0005 in. ahead of rougher to avoid moving fixture. AM—Oct 10 '55, p146

Characteristics of ceramic tools are such that they are better run dry, and run better than carbides at higher temperatures. They may be useful for hot-spot machining. Tip remains cool, and chips do not weld to it. They permit feed and speed combinations well beyond the capacities of most present machine tools, but still give better finishes and higher speeds within the limits of present machines. AM—Mar 12 '56, p157

These two sections will be a "How-to-do-it" reference of machining and tooling ideas and production techniques valued in metalworking plants. And these are only two of eight "Nugget" sections, the others covering management and personnel, molding and casting, inspection, testing and quality control, assembly and heat-treat, materials and components, materials handling and services.

Challenging Checklists

"Developments to Watch in '57"—challenging checklists of up-to-date Metalworking production ideas and techniques appearing in each section will present subscribers with an opportunity directly to choose machining and tooling ideas applying to their own operations and requirements, and adapt them for immediate use.

Lists of "Manufacturers Free Literature," classified by subject matter, will be published in each section—an additional subscriber convenience to permit easy gathering of further information germane to machining and tooling in the same place, these editorial topics are reported—and while production ideas are fresh.

1400 Headings—7000 Sources

Over 7000 sources of supply for the production equipment, materials, parts and supplies will be classified under 1400-odd headings in the Buyer's Guide section of the issue, providing subscribers with a complete and authoritative "Where-to-Buy-it" reference. The headings cover every conceivable product used in Metalworking plants—from Abrasives to Zinc.

A Standing Reference Issue

Year-round usefulness will be built into the volume by thumb-indexing 10 of the 11 sections; flat-opening binding; and shop-oriented classification of topic matter. American Machinist's 1957 Production Planbook and Buyer's Guide Issue is planned as a service exclusive to American Machinist subscribers to provide "How-to-do-it," "What-to-do-it-with" and "Where-to-buy-it" ideas obtainable nowhere else in a single issue.

Photos courtesy AMF-Brooklyn

1957 OUTLOOK

MANAGEMENT, PERSONNEL A

MACHINING B

TOOLING C

PRESSWORKING, MOLDING, CASTING D

INSPECTION, TESTING, QUALITY CONTROL E

ASSEMBLY, HEAT-TREAT, FINISHING, (ASSEMBLY INCLUDES WELDING & PORTABLE TOOLS) F

MATERIALS, COMPONENTS G

MATERIALS HANDLING, SERVICES H

PRIZE IDEAS, REBUILT EQUIPMENT I

BUYER'S GUIDE J

HOW JOHNSON* MAKES A BETTER OUTBOARD MOTOR WITH ALCOA SCREW MACHINE STOCK

The outboard motor of 1921 was a heavy iron and brass thing that literally shook a boat to pieces. In that year, Johnson Motors and Alcoa changed the whole picture. The first Johnson Waterbug combined astounding lightness (35 pounds) with unheard-of power (2 hp) in a radical twin cylinder design. In three years, Johnson was the largest outboard manufacturer in the business.

Today, Johnson is still the largest. Its use of Alcoa® Aluminum Screw Machine Stock makes interesting reading to any manufacturer wanting to improve his product and make it sell faster.

Few products demand so much from machined parts as outboard motors—lightness, strength and corrosion resistance, too. These three advantages often set aluminum head and shoulders above other materials for screw machine parts. But consider the other advantages of aluminum which may have a more important place in your product. Exceptional machinability—limited almost entirely by machine capacity; high electrical and thermal conductivity: ease of finishing. These performance characteristics of Alcoa Screw Machine Stock, when coupled with the solid economic fact that you get three times as many parts per pound as with heavy metals, make up the total good sense of aluminum.

These are hard, commercial reasons why aluminum more than ever before should be carefully considered for every screw machine part you make or buy. Help in this type of analysis is available from every one of Alcoa's local sales offices listed in your phone book under "Aluminum." Aluminum Company of America, 868-G Alcoa Building, Pittsburgh 19, Pennsylvania.

*Johnson
MOTORS
Waukegan, Illinois

Chief Engineer, S. A. Metcalf (at right);
Ed Stoyonoff, Senior Draftsman (at left).

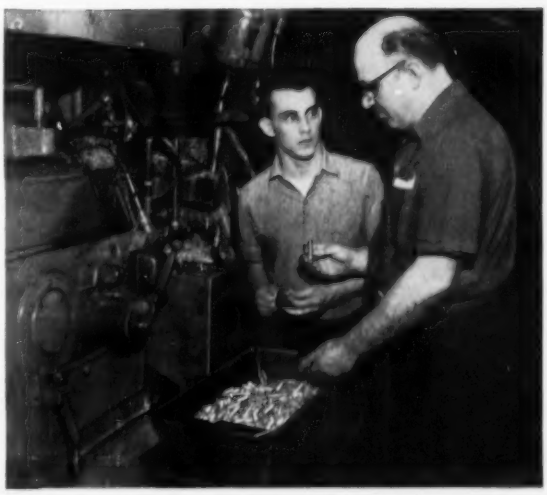
IN PURCHASING

Purchasing Agent, J. G. Kohler, says—"We have always used Alcoa Aluminum Screw Machine Stock and today we buy 100% of our requirements from Alcoa. We have never had a reject to my knowledge. It is this dependability of service, coupled with Alcoa technical help and Alcoa technical booklets, that keeps Alcoa strongly in our supply picture. Being the world's largest maker of outboard motors, we must schedule our buying closely to production. We know we can depend on Alcoa."

Purchasing Agent, J. G. Kohler.

IN PRODUCTION

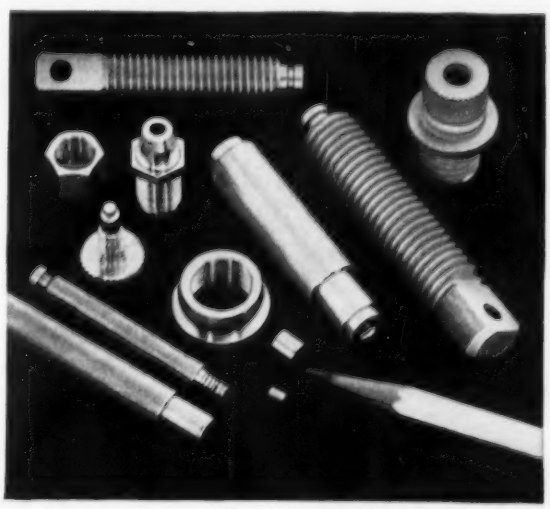
Foreman of Automatic Screw Machine department, F. H. Mitchell, says—"We run aluminum at the top capacity of our machines. Tolerances are often as close as two-tenths. Aluminum machines so easily that we often reduce the O. D. of a part with die chasers. We also find that the cutoff finish we get with aluminum is superior to brass and steel. Tool life is fine. Tool preparation for aluminum is easy. We use Alcoa booklets as standard reference material and aluminum gives us no headaches in production. We like it."



Foreman, F. H. Mitchell (at right);
James Hairrell, Machine Operator (at left).

IN DESIGN

Chief Engineer, S. L. Metcalf, says—"Our prime design consideration at Johnson is putting the most power possible in every pound of motor. For this reason we naturally rely on aluminum for over 50 screw machine parts. In addition, we have severe corrosion requirements—another reason for our use of aluminum. The fact that we get three times as many parts per pound with aluminum as with heavy metals also helps us make a better motor at lower cost. Alcoa technical help is always at our disposal. Because we use so much aluminum on our motors, we frequently have threaded aluminum parts mated with other aluminum parts. In these cases, the ease of anodizing aluminum nicely avoids any possible problems of seizure and salt water corrosion."



Typical parts made of Alcoa Aluminum
Screw Machine Stock by Johnson Motors.

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
SCREW MACHINE STOCK
ALCOA

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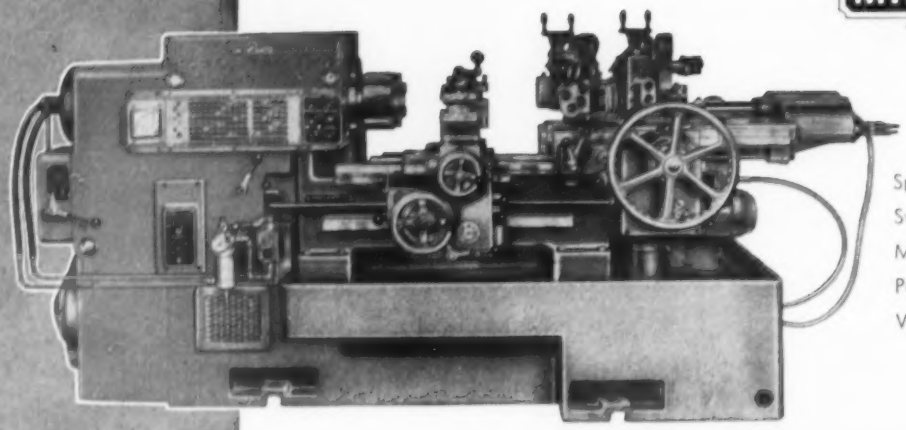

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Spindle bore	2 1/4"
Swing	18"
Max speed	rpm 3000
Power	HP 8
Weight	lbs. 6000

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"CAMLESS"
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Northfield **KEYSEATER**
Model K-6

The New Northfield Model K-6 Keyseater is designed to cut straight or tapered keyways from ⅛" to 1" wide. Work of any shape and diameter can be clamped to the table and cut, grooved, or slotted.

Well engineered design features assure work of exceptional accuracy. Over 30 years of quality machine design and manufacture guarantee satisfaction.

Northfield FOUNDRY & MACHINE CO.
★ ★ ★ NORTHFIELD, MINNESOTA, U. S. A.

DO ALL These Jobs with ONE TOOL
SMITH'S
180° UNIVERSAL BRAKE

Smith's 180° Universal Brake is *the answer* to the need for one low cost tool that can handle a wide variety of bending and forming jobs with speed and accuracy. Designed to permit selective bending of portions of a workpiece without restriction, the Universal Brake's application and use is literally unlimited. It will handle 18 gauge mild steel 26" wide to 7 gauge 1¼" wide, at any angle, up to 180° in one operation. It has adjustable angle stops and back gauges to assure precise duplication of work pieces, making it a very valuable production tool. Write for illustrated circular and more details.

R. E. SMITH 1122 ELIZABETH AVENUE WAUKEGAN, ILLINOIS

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Please send me your free 192-page Buyers Stock Book and Catalog No. 56.

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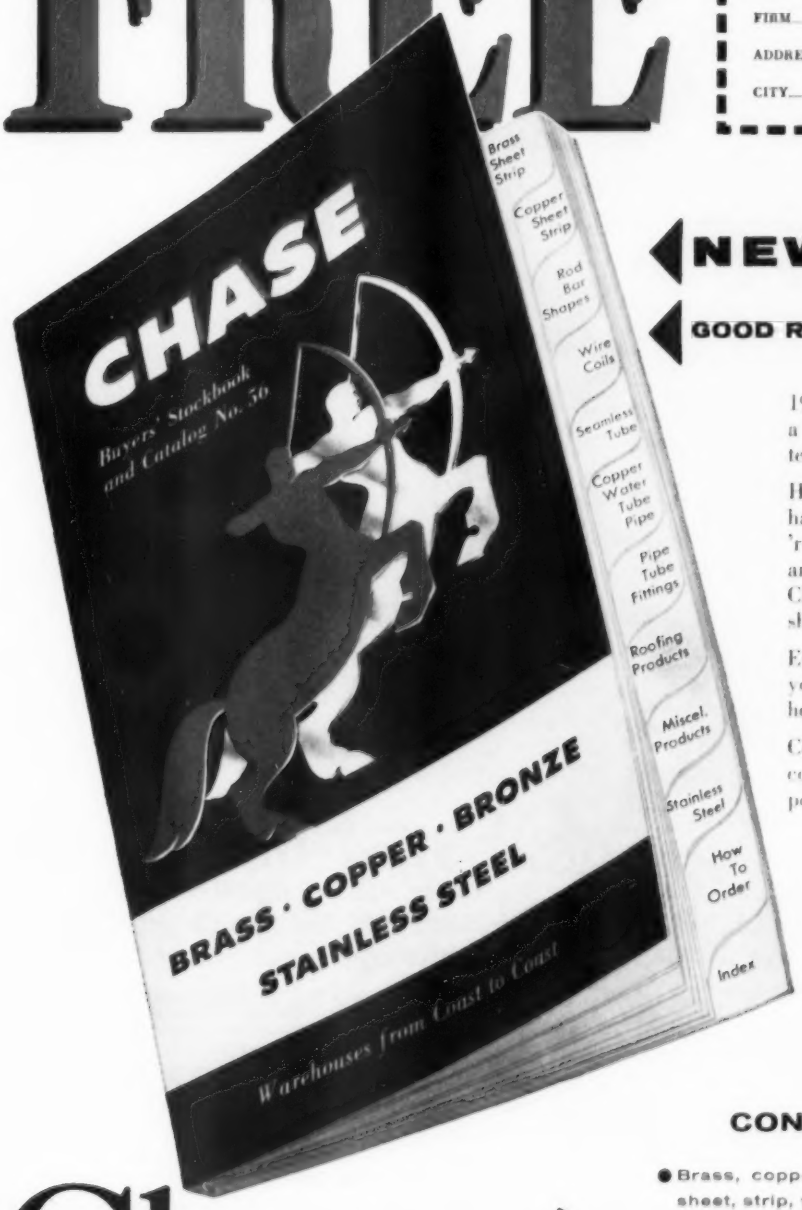

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192 pages of illustrations and listings of a variety of products...sizes...weights... tempers...shapes!

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these record-slashing KLING SHEARS are winning . . . . . .

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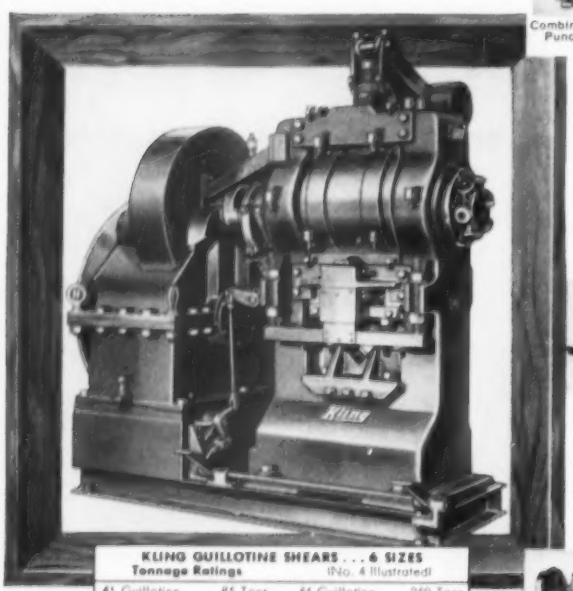
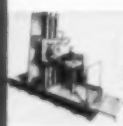
Rotary Shears

Combination Shear, Punch & Coper

. . . "Production Oscars" in many plants



KLING GUILLOTINE SHEARS . . . 6 SIZES Tonnage Ratings (No. 4 Illustrated)			
#1 Guillotine	85 Tons	#4 Guillotine	250 Tons
#2 Guillotine	125 Tons	#5 Guillotine	450 Tons
#3 Guillotine	175 Tons	#6 Guillotine	650 Tons



Beam and Column Millers

Bulldozers

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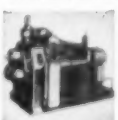
Horizontal Stroke Friction Saws

Hydraulic Power Units for Friction Saws

Universal Punches



Angle Bending Rolls

Plate Bending Rolls

We are constantly adding new features to the various models of Kling Shears, so that you should be able to get even better performance than the remarkable reports like these that we receive from Kling Users. "Labor costs cut 75%," says a Chicago manufacturer and a famous company reports, "We now get 16 hours work from an 8-hour shift." Ask for descriptive bulletins on the particular model of shears in which you are interested.

other KLING metal-working machines that are cutting costs and speeding production

If your operations include such jobs as cutting, punching and shearing beams, channels or angles . . . shearing round or flat bars . . . rolling structural shapes . . . performing special operations such as flanging, slitting or coping . . . or milling beams and columns . . . it will pay you to send for Kling Bulletin 100. This "condensed catalog" gives full details on machines* shown here, that do these jobs faster, better and at lower cost.

**Ask for special Bulletin if interested in MILL-ALL Beam and Column Miller*

Since 1892

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Active Kling Distributors cover practically every marketing area of U.S. and Canada. Write us for name of one nearest you.

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Makers of Friction Saws; Shears—Rotary, Double-Angle and Guillotine; Punches; Combination Shear, Punch and Coper; Angle and Plate Bending Rolls; Bulldozers.

Export Distributor: Simmons Machine Tool Corp., 50 E. 42nd St., New York 17, New York
Canadian Distributor: Brown-Boggs Fdry. & Machine Co., Hamilton, Ontario

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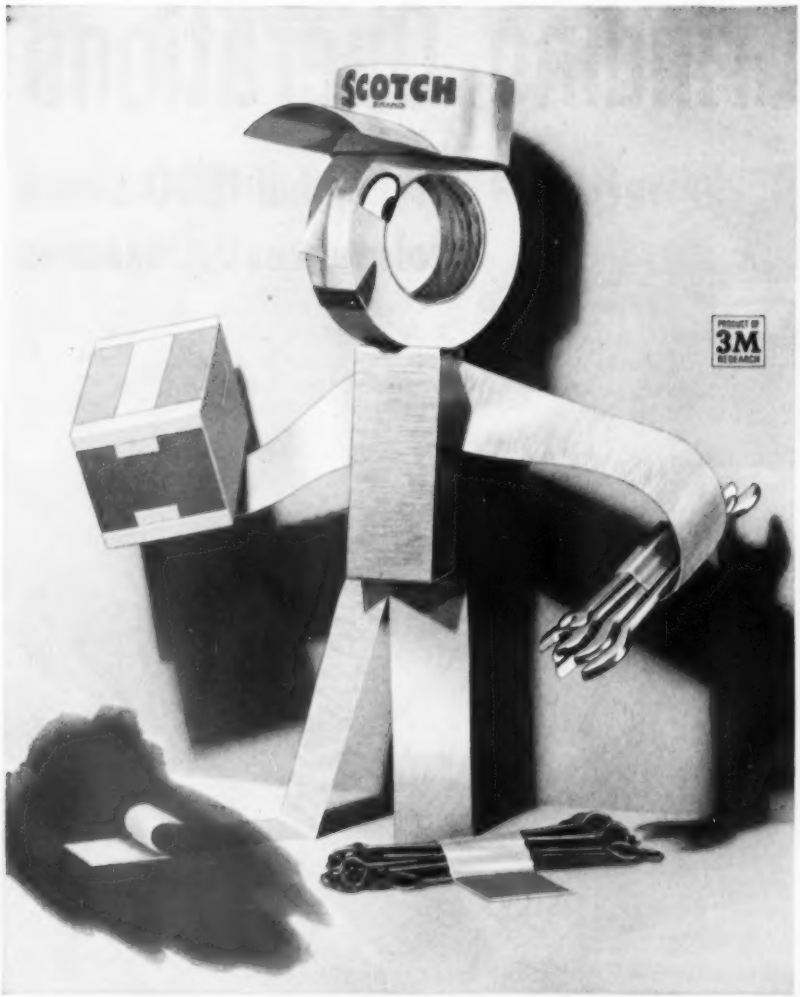

All-around tape helper works for pennies a day!

"SCOTCH" Brand Masking Tape can do dozens of other jobs besides paint-masking: hold, bundle, seal, bind, band . . . these are but a few applications for these versatile tapes. The pressure-sensitive adhesives stick at a touch; both flat and creped backings available. Ask your tape distributor about "SCOTCH" Brand Masking Tapes. And remember, always specify "SCOTCH" Brand, the quality tape . . . and stick with it!

MASKING TAPE . . . *one of more than 300 pressure-sensitive tapes for industry, trademarked . . .*

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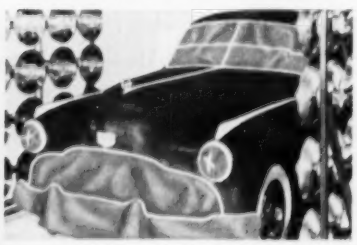
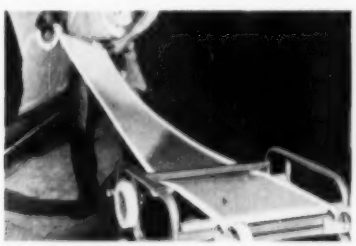
SCOTCH BRAND

Look what you can do with it!

MASK any size, any shape area before painting with "SCOTCH" Brand Masking Tape and Masking Paper. Tape's adhesive sticks tightly to prevent paint "bleeding" or creeping. Strips off clean . . . won't stain.



HIGH HEAT paint baking operations pose no problem with "SCOTCH" Brand Masking Tape No. 216. Tape withstands bake-oven cycles to 280°F.; may be used with all popular ovens.



SPEED large-area masking with "SCOTCH" Brand Masking Tape, Masking Paper, and "SCOTCH" Brand Apron Taper. Taper delivers paper with masking tape already applied to one or both edges.

SEND FOR FREE FOLDER showing dozens of ways you can improve painting and finishing operations with "SCOTCH" Brand Masking Tapes. Write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. MA-76.

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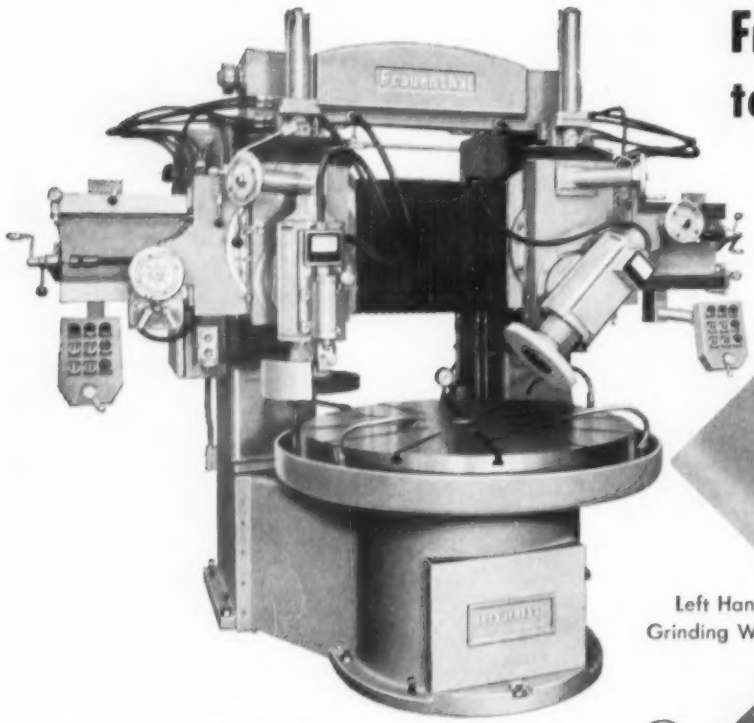
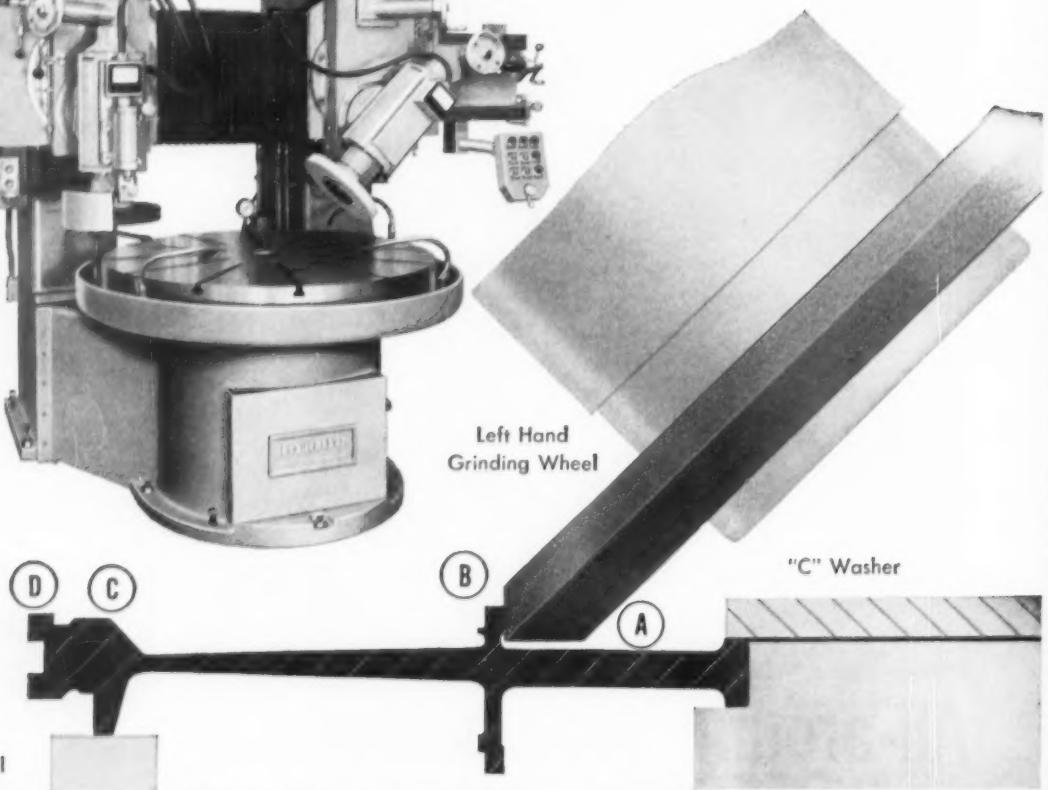
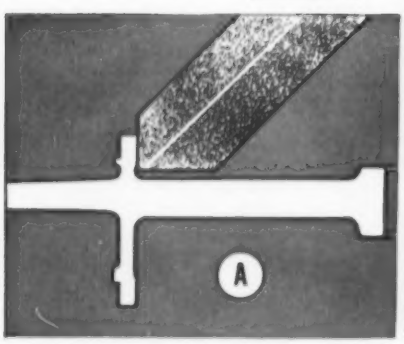
Multiple Grinding Operations

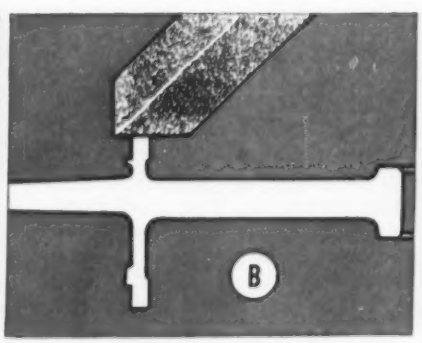
Frauenthal 1800 Series tolerances . . . assures



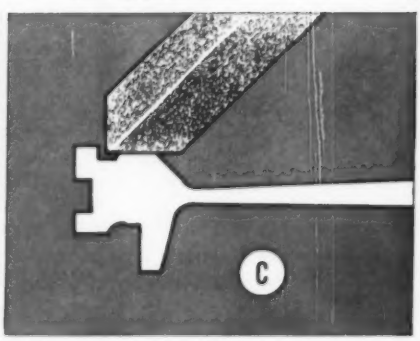




Jet engine part is set up on steel parallels and securely clamped to center pilot with large "C" washer.



Rigid mounting and proper alignment assures a high degree of accuracy in parallelism and roundness. Left hand



grinding wheel grinds one diameter and three related surfaces to extremely close tolerances.

Frauenthal Division

in One Set-Up

Double Head machine finish grinds 6 surfaces to close concentricity of related surfaces...reduces grinding costs

As ILLUSTRATED in the schematic diagrams, three different diameters and three related surfaces of a jet engine component are precision-ground square and concentric with one another in a single setup using two grinding heads. This is a typical example of how a Frauenthal 1800 Series Double Head Grinder cuts grinding costs.

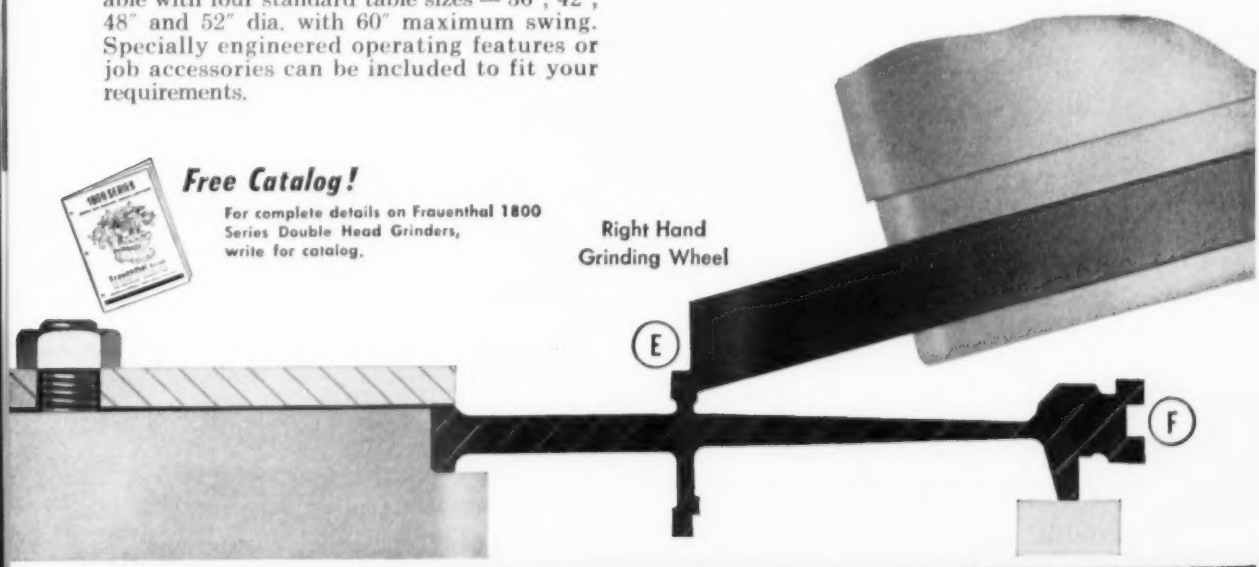
Frauenthal 1800 Series Grinders are available with four standard table sizes — 36″, 42″, 48″ and 52″ dia. with 60″ maximum swing. Specially engineered operating features or job accessories can be included to fit your requirements.

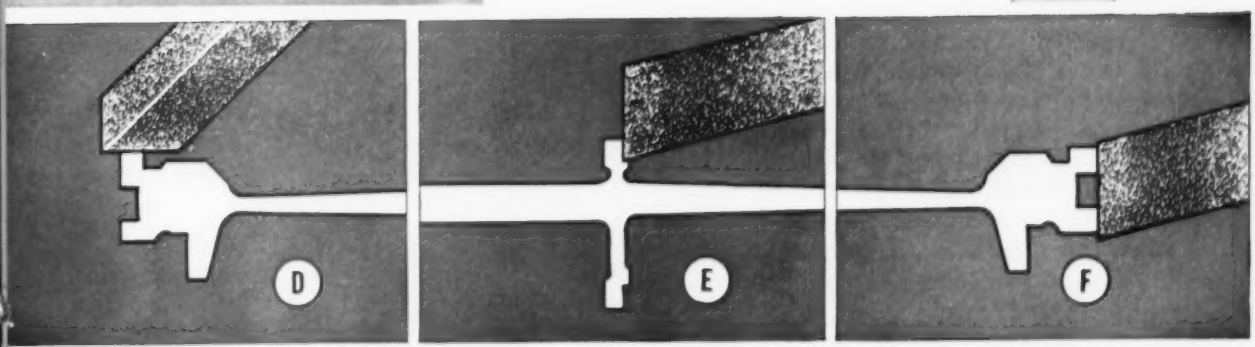
With Frauenthal Grinders (1800 Series or 2200 Series) you're able to grind a number of related surfaces (up to 140″ dia.) without changing setup of workpiece, and obtain accuracies within .000200″. This assures you *consistently* uniform precision in concentricity, parallelism and roundness.

For complete details, contact Frauenthal of Muskegon.

Free Catalog!

For complete details on Frauenthal 1800 Series Double Head Grinders, write for catalog.





Starting from center of workpiece it finish grinds INNER diameter "A", and TOP FACES "B", "C" and "D". Right hand grinding wheel finishes OUTER diameters "E" and "F". Both spindles are swiveled for accessibility to the workpiece surfaces. All surfaces of jet engine part are ground within .000200".

THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN

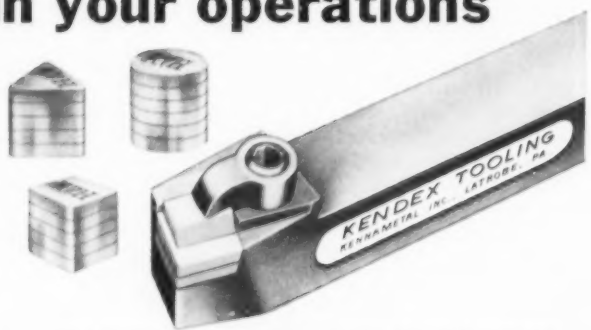
KENNAMETAL

K7H

has a definite place in your operations

- for high-velocity machining
- for cutting heat-treated steels
- for cutting high tensile steels

Kennametal* Grade K7H is being selected by shop after shop for high-velocity cutting operations . . . chiefly because of these desirable cutting edge characteristics: High hardness (93.5 Rockwell A) combined with phenomenal strength (three times that of nonmetallics); exceptional wear resistance and maximum resistance to cratering; excellent retention of strength even at high temperatures; and top resistance to shock.



Use Kendex Tooling with turn-over inserts (available in 17 styles and over 200 tools) . . . for lowest cost per cutting edge.

HERE ARE EXAMPLES OF K7H PERFORMANCE

Doubles production: Cutting 1½″ wide stators of welded laminations of 2% silicon steel, K7H has out-performed all other cutting edges by better than two to one, with 147 pieces averaged per index for K7H against only 65 pieces per index with the best competitive carbides. *Conditions:* 900 sfm, .0083″ feed, and .015″ depth of cut. *Results:* Higher total production at end of day, with less machine down time, less scrap, better quality by holding tolerances, and lower tooling cost per stator ($0.00109).

Outperforms ceramics by more than 30 to one in test boring SAE 1020 steel, flash hardened, length of bore 1¼″, depth .025″ at 900 sfm. Grade K7H cut 67 pieces while ceramics only cut two (ceramics chipped). *Result:* K7H ordered for the operation.

K7H cuts 252 pieces as compared to 30 . . . the best record for a competitive carbide in facing cut to dead center of SAE 1018 steel 5″ O.D. gear blank, at 1000 sfm (at outer edge) and .008″ depth of cut. *Result:* Standardized on K7H.

Performance 3 times greater than with competitive carbide cutting cast steel stator housing with six interruptions at 700 sfm, .014″ feed, and ⅛″ depth of cut. *Result:* K7H was selected for the job.

Why not discuss your machining problems with a Kennametal tool engineer. He will help you take full advantage of this remarkable cutting grade. Call him or write KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark

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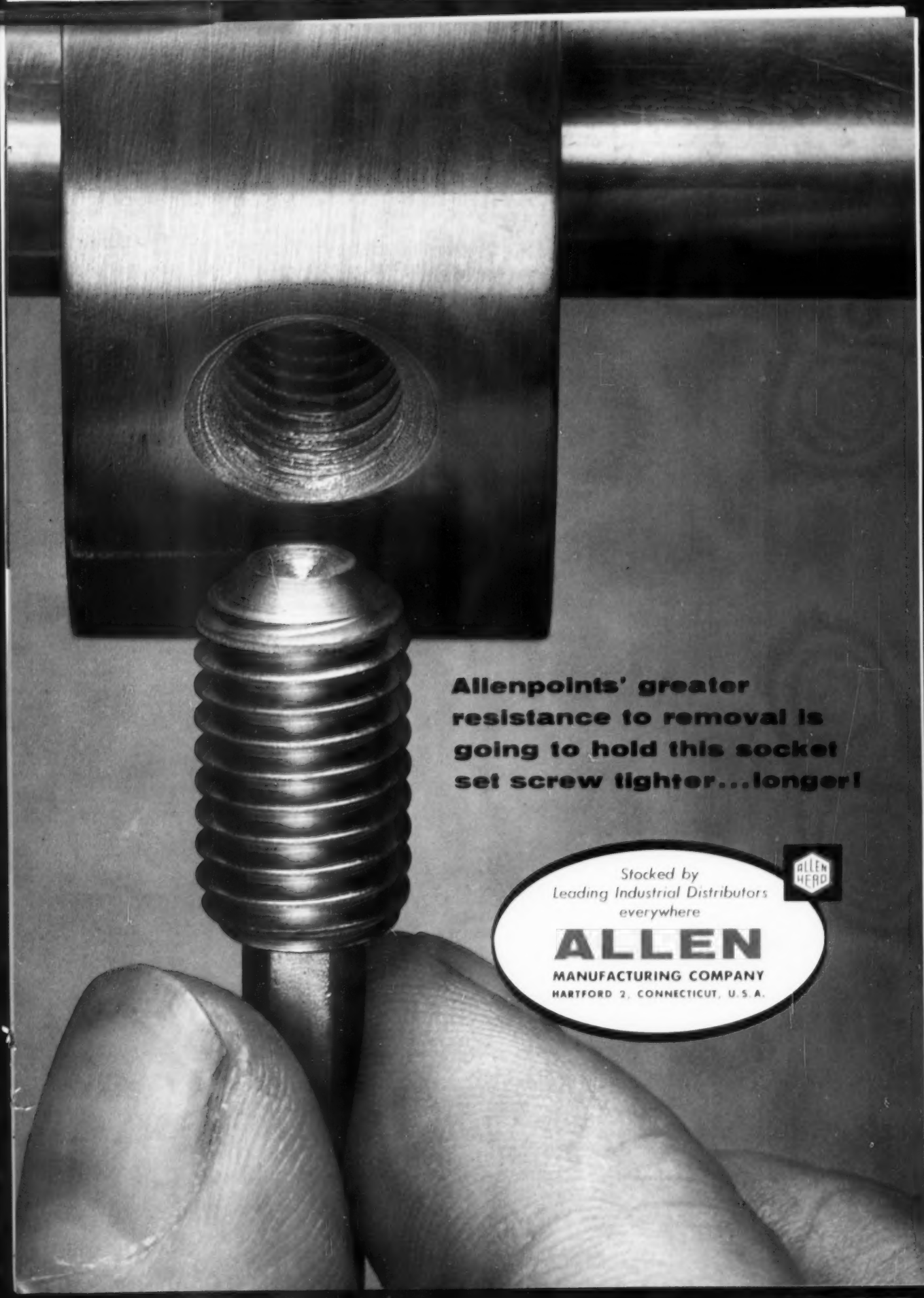
INDUSTRY AND KENNAMETAL ...Partners in Progress


Allenpoints' greater resistance to removal is going to hold this socket set screw tighter...longer!
Stocked by Leading Industrial Distributors everywhere
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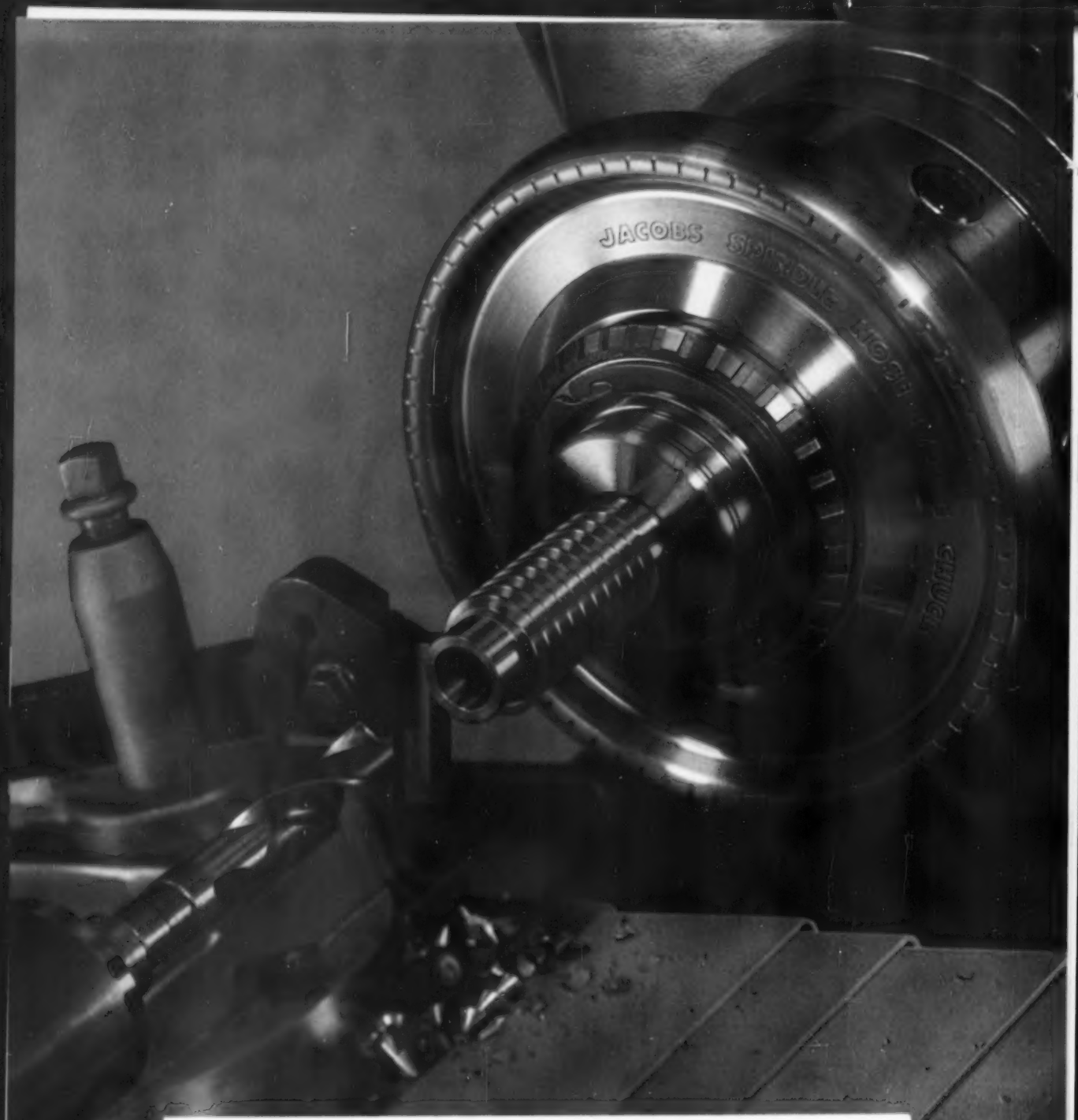

Drill and cut with accuracy . . .

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Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

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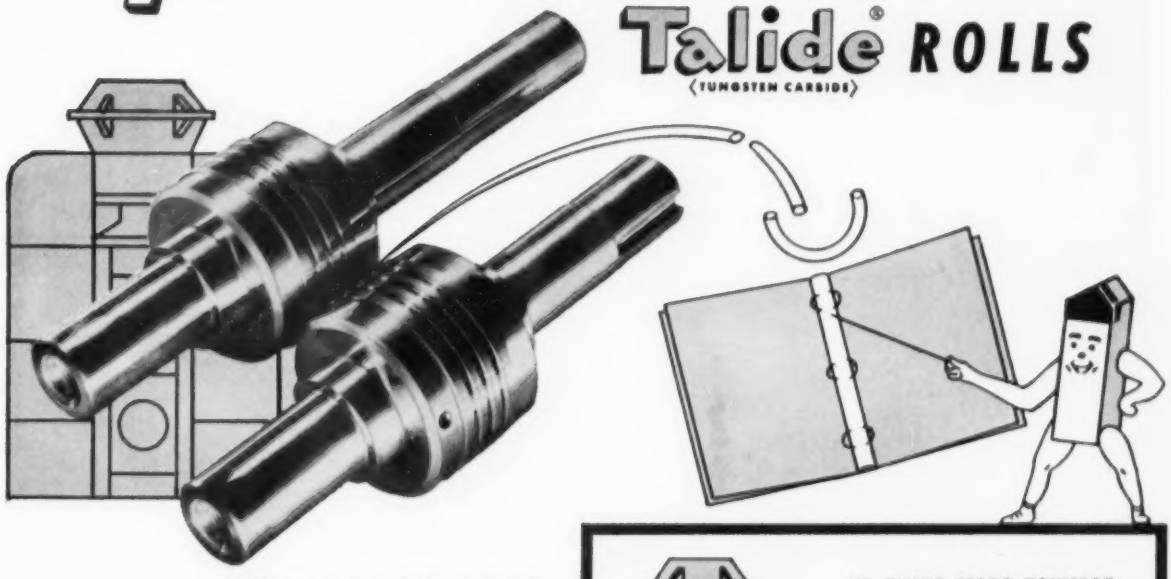
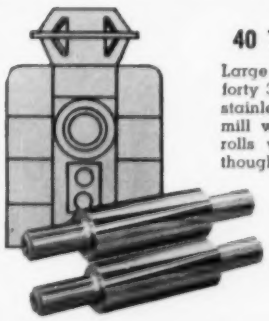
7 years' continuous service with Talide® ROLLS

(TUNGSTEN CARBIDE)



● A large Eastern Producer of oval-shape wire for loose-leaf notebook rings was experiencing excessive wear and pick-up. The high scrap rate was making the item unprofitable. Metal Carbides service engineers were called in to determine if Talide rolls could correct the trouble. Hi-carbon wire was being reduced on a 2-hi cold rolling mill to an oval shape .100" thick x .156" wide. Considerable stress and pressure was required to deform the wire to proper shape.

Our engineers designed a roll incorporating a carbide sleeve having 3 grooves ground in periphery and mounted to a special alloy steel arbor. The initial pair of rolls was installed in 1948 and has been in continuous service ever since. Due to their extreme hardness it has not been necessary to remove them from the mill during this 7-year period—not even for a regrind! Size and shape of wire has been perfectly maintained. Customer has since installed similar rolls on all their mills.



40 TIMES MORE TONNAGE

Large Steel Producer cold rolls forty 3,000 lb. coils (60 tons) of 18-8 stainless steel, series 300, on 4-hi mill with one pair of solid Talide rolls with no surface wear, even though strip work hardens to 50 Rockwell "C" in one pass. Flatter, smoother strip produced—even when rolling intermittent widths. 40 pairs of steel rolls were required previously to produce same tonnage.

SUPERSET GRINDING WHEEL

The Superset diamond grinding wheel was specially developed for grinding carbide rolls to highest possible surface finish and luster. Made of 4-8 micron size diamond dust, it imparts a surface finish far superior to any other commercial wheel. Available in sizes up to 25" diameter.

ROLL LIFE INCREASED 278 to 1!

All users of Sendzimir rolling mills have adopted Talide work rolls because operating results have been phenomenal, far surpassing all expectations. Tremendous production runs are commonplace with mill after mill reporting increased tonnage runs between roll changes of 278-1, 179-1, 82-1, etc.

EXCLUSIVE REPAIR SERVICE

BEFORE

AFTER

Broken or damaged carbide rolls can be re-worked to first class condition with all defects eliminated at one-half original cost. Only Metal Carbides offers this service—because of its exclusive hot press method.

Metal Carbides Corporation,
Youngstown 12, Ohio.

Send for new 84-page catalog 56-G

Talide Rolls are made in lengths up to 100", diameters up to 25", and up to 5000 pounds by weight.

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TALIDE®

YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
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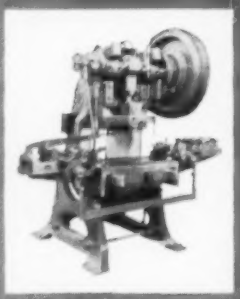
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

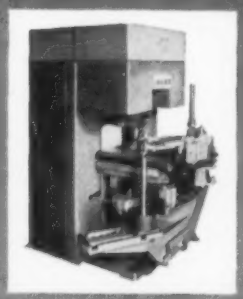
Which one is best?



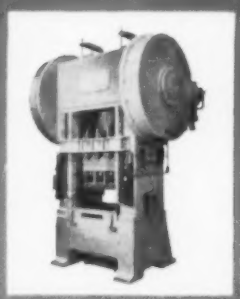
INCLINABLE . . .

Talk to the man

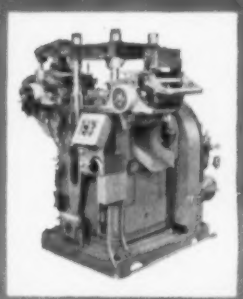
Presses and methods that automatically reduce costs



NOTCHING MACHINE . . .



STRAIGHT SIDE . . .



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Our representative is as near to you as your telephone. The names and addresses of the companies representing us are listed on the right. Don't miss calling in these experts on any press replacement or modernization program.

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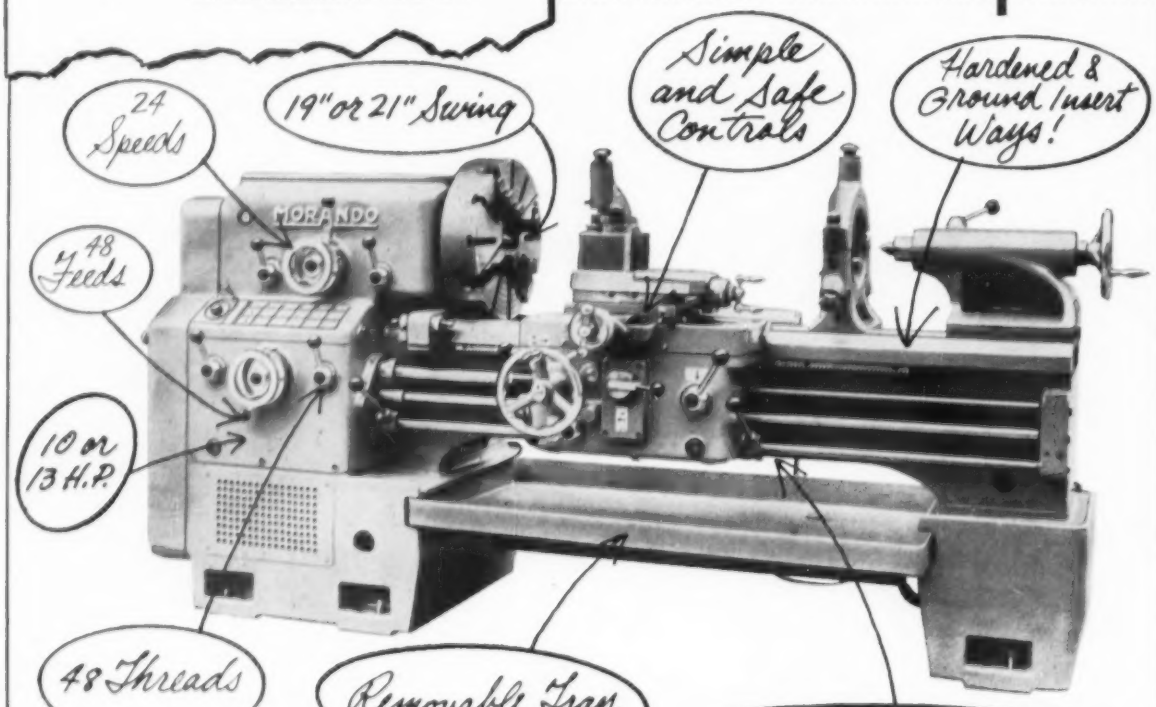

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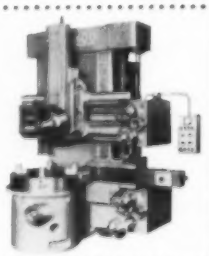

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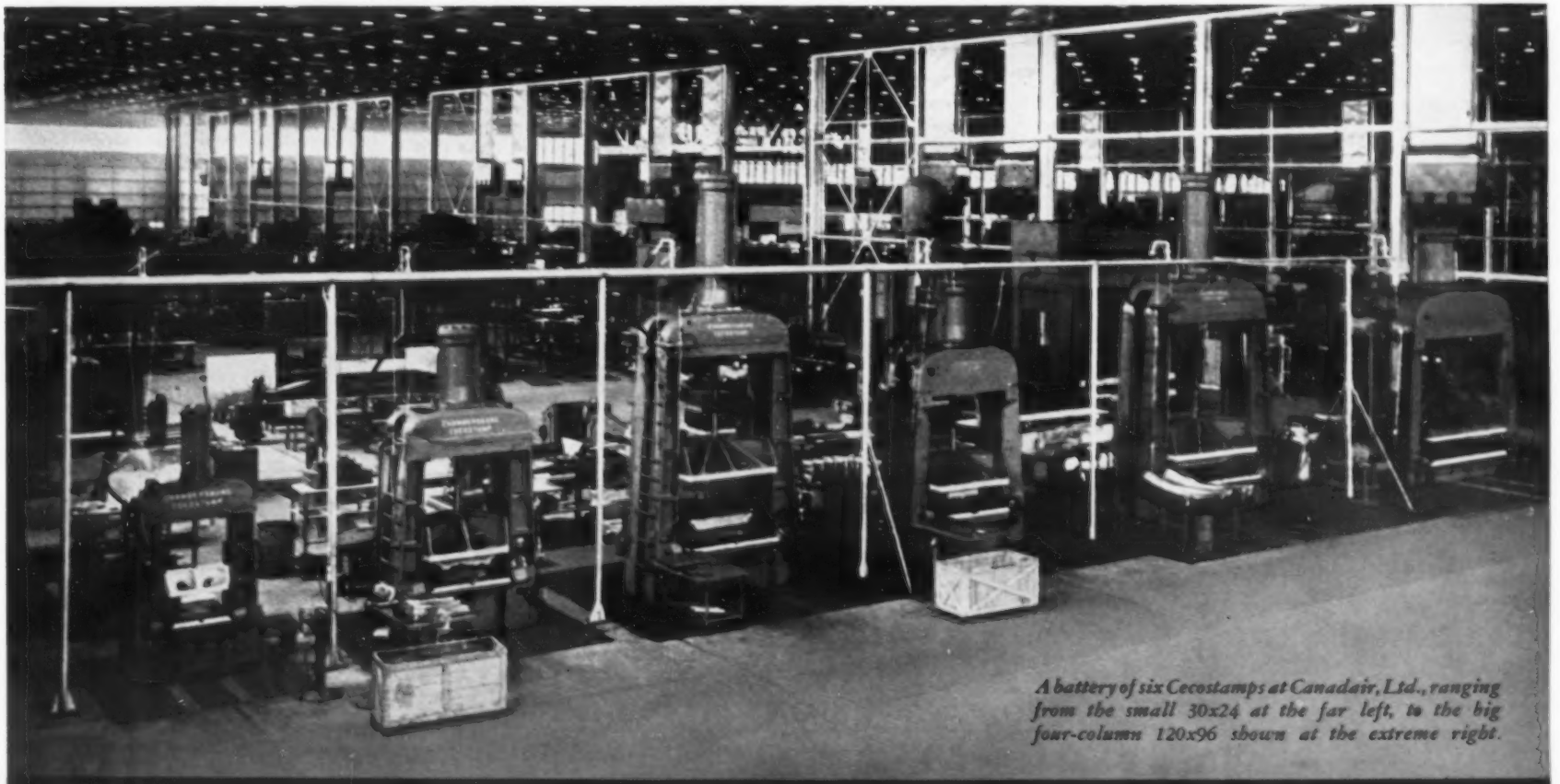

A battery of six Cecostamps at Canadair, Ltd., ranging from the small 30x24 at the far left, to the big four-column 120x96 shown at the extreme right.

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Technical-ities

By John S. Davey

What's the right torque for bolts?

This is one of the toughest questions we're asked. Too many variable conditions. But the following may help.

The bolt takes two stresses during wrenching: (1) Torsion, (2) Tension. Tension is what you want. Torsion is the necessary evil due to friction. Probably 90% of applied torque goes to overcome friction.

With the friction factor changed by lubrication, plating, etc., the torque needed to produce a given tension is hard to predict. However, a useful empirical formula exists for *normal* friction conditions.

Inch-lbs. Torque = 0.2 x bolt diameter x bolt tension

Many tests show that the 0.2 torque coefficient is approximately constant for the usual friction conditions, for all diameters, and for both coarse and fine thread. Average deviation is about 7%. But when are conditions *"normal"?* The only *sure* way to check torque is to set up a pilot assembly and try it out.

In pilot testing for rigid joints, tighten a few bolts with torque wrench to failure, and then set torque at 75% of that load; or even at yield strength, since torsion component vanishes leaving bolt under tension only, which is well below ultimate strength.

We've worked up curves giving suggested torques for various size bolts. Send for a copy.

How to make a stronger joint

From research on structural steel joined with high strength bolts come facts applicable to *products:*

These bolts can be torqued to high tension for a large clamping force on joined members. Resultant friction overcomes shearing forces and prevents slippage. The higher compressive forces also protect bolt holes from fatigue cracks. Moreover, the tighter the bolt, the less chance for loosening, and the less risk of bolt fatigue due to dynamic loading.

High strength bolts are stronger in shear, too. In recent tests, rivets and "soft" bolts broke under extreme shear load; but high strength bolts didn't—the joined steel failed first.

APPLYING THE ADVANTAGES

Since high strength bolts have 2 to 3 times more tightening strength than common bolts, smaller diameter bolts can be used. As discussed above, these make a stronger joint; also weigh and cost less.

Along with good joint design, it's important that fasteners used can meet requirements. For example: A manufacturer designed vibrating machinery for high tensile bolts, but it was assembled with low carbon bolts. Joints failed. RB&W high carbon bolts with hardened washers solved the problem.

Moral: *Specify* even your standard fasteners.

RB&W selects the proper grade of steel to give "Empire" high strength fasteners the precise balance between *tensile strength* and *ductility.*

Feel free to call on RB&W for help in selection and use of standard, low cost fasteners.

Three radial dashes on bolt head denote a high strength bolt. The "E" identifies Empire bolts, an RB&W trademark. These markings assure highest quality standard fasteners with full strength, and uniformity of size and physicals.

●

Russell, Burdsall & Ward Bolt and Nut Company . . . plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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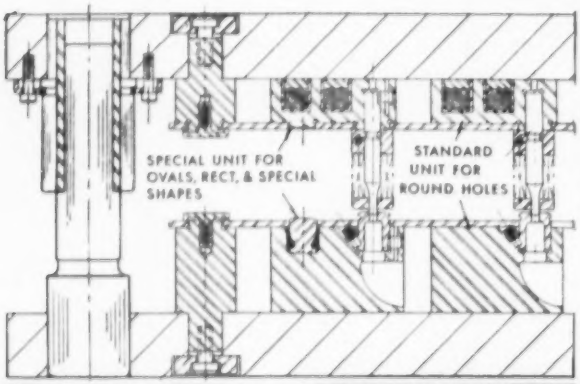

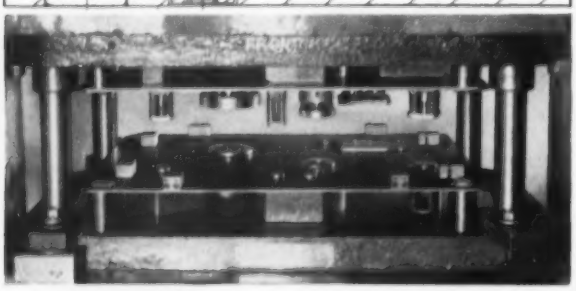

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*Whistler Magnetic Dies are fully patented and are sold under the copyrighted trade name Magna-Die.

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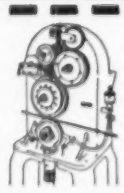

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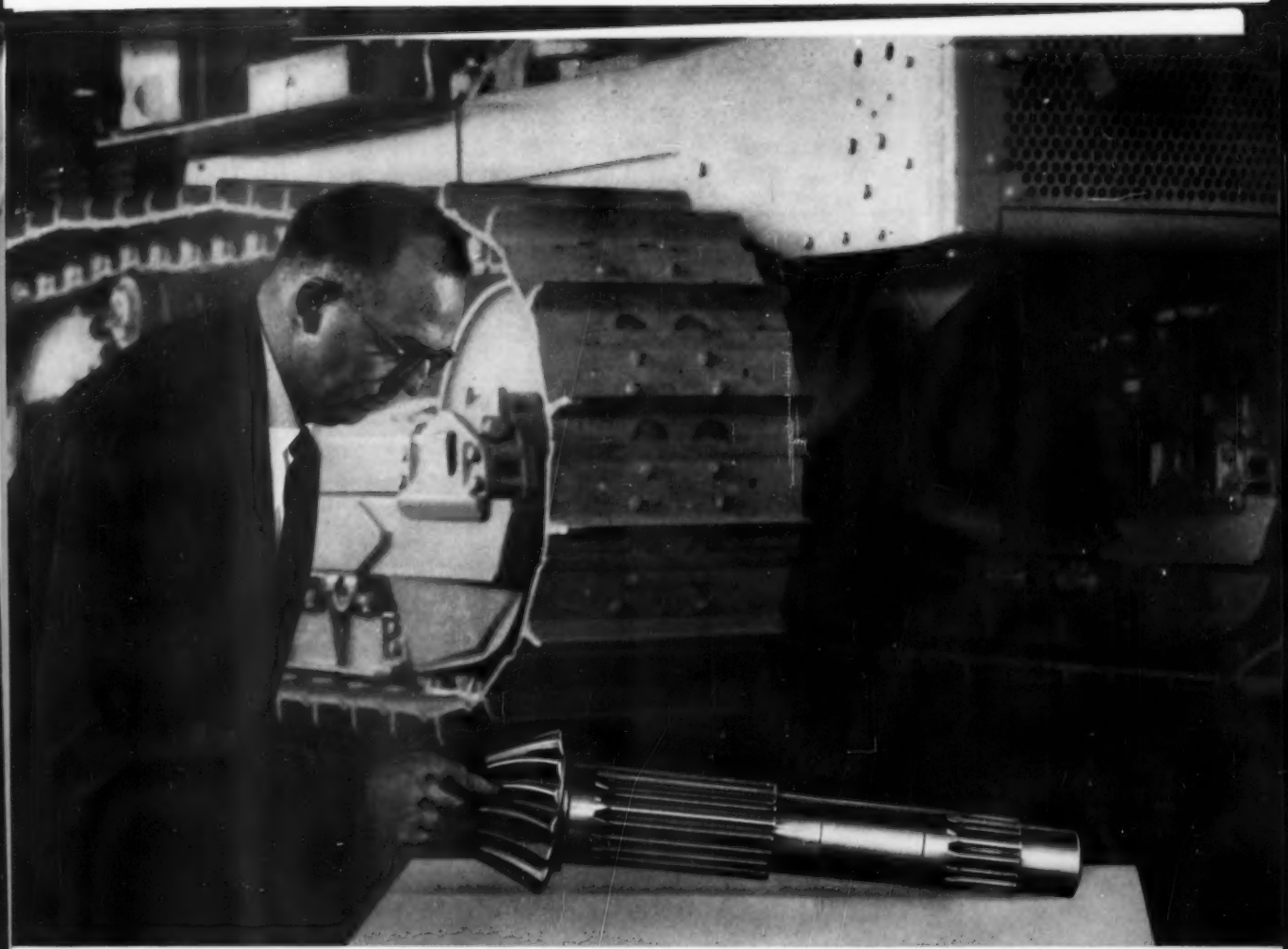

Caterpillar Tractor Co. Metallurgist T. H. Spencer inspects final drive pinion for D9 crawler tractor weighing 28 tons. Severe loading of this large pinion requires a steel with high case and core hardenability. Several years ago Caterpillar Tractor Co. found that simply by increasing the molybdenum content of AISI 8622 (to 0.30-0.40%), the desired properties were obtained at lower cost than was possible in any of the standard carburizing grades.

Caterpillar Tractor Co. improves case and core hardenability of carburizing steel by increasing molybdenum content

"Drive pinions in tractors must take very high torque loads," says T. H. Spencer, Metallurgist for Caterpillar Tractor Co. "AISI 8622 steel, which we had been using, couldn't give us the hard case and strong, tough core we needed in these heavy sections. Other standard carburizing steels with the requisite properties would have cost substantially more. We found, however, that we could achieve the desired surface and core properties by simply modifying AISI 8622 with a higher percentage of molybdenum. We have been using this composition for several years, and results have been excellent."

Caterpillar Tractor Co.'s experience shows how increasing molybdenum in a carburizing steel helped to solve a specific problem. Perhaps your product, too, can benefit by higher molybdenum content.

A technical article, "New Carburizing Steels for Critical Gearing", describes some recent investigations of higher-moly carburizing steels. For a reprint, write Climax Molybdenum Company, Dept. 12, 500 Fifth Avenue, New York 36, N. Y.

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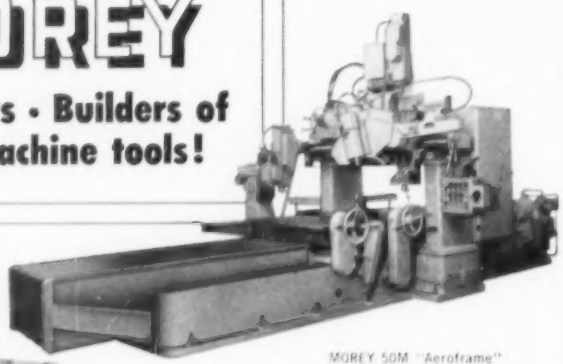
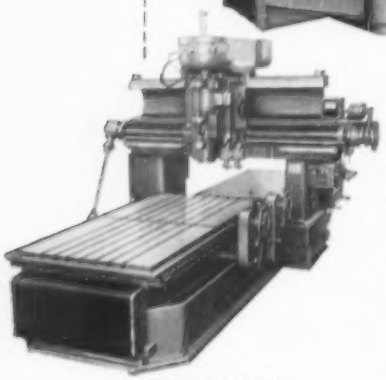


MOREY 50M "Aeroframe" Profile Milling Machine with tilting head



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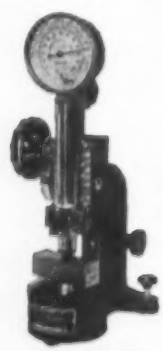

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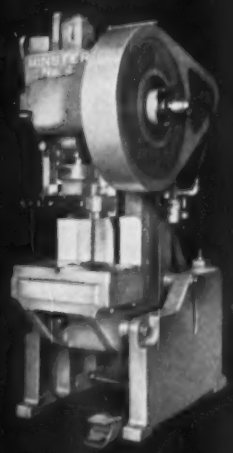

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Straight Side Two Point Presses
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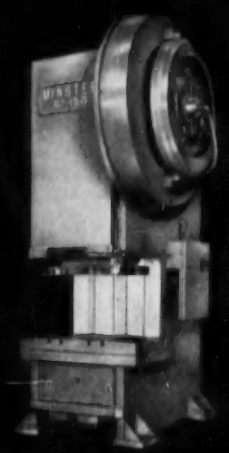
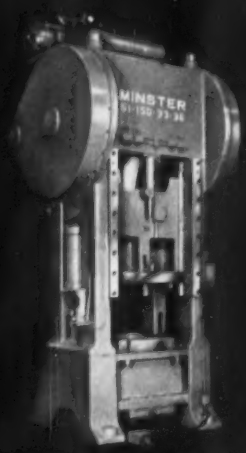


Fixed Base Single Point Presses
32 tons through 200 tons



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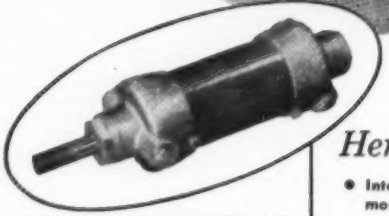

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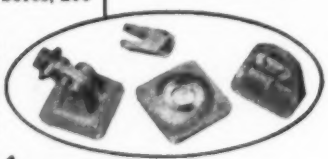

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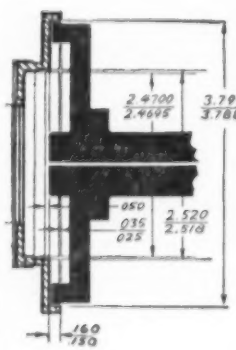

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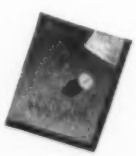

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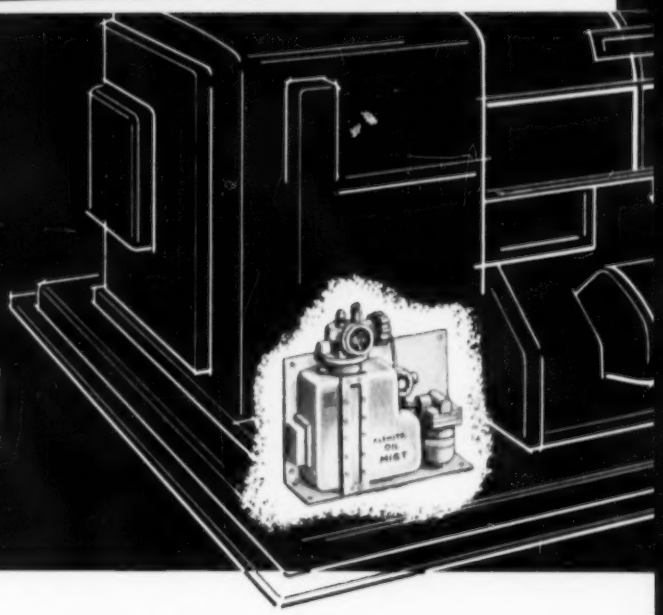

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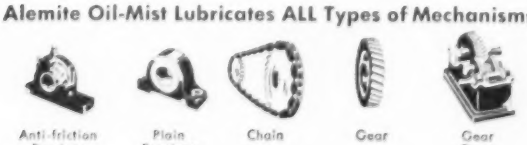

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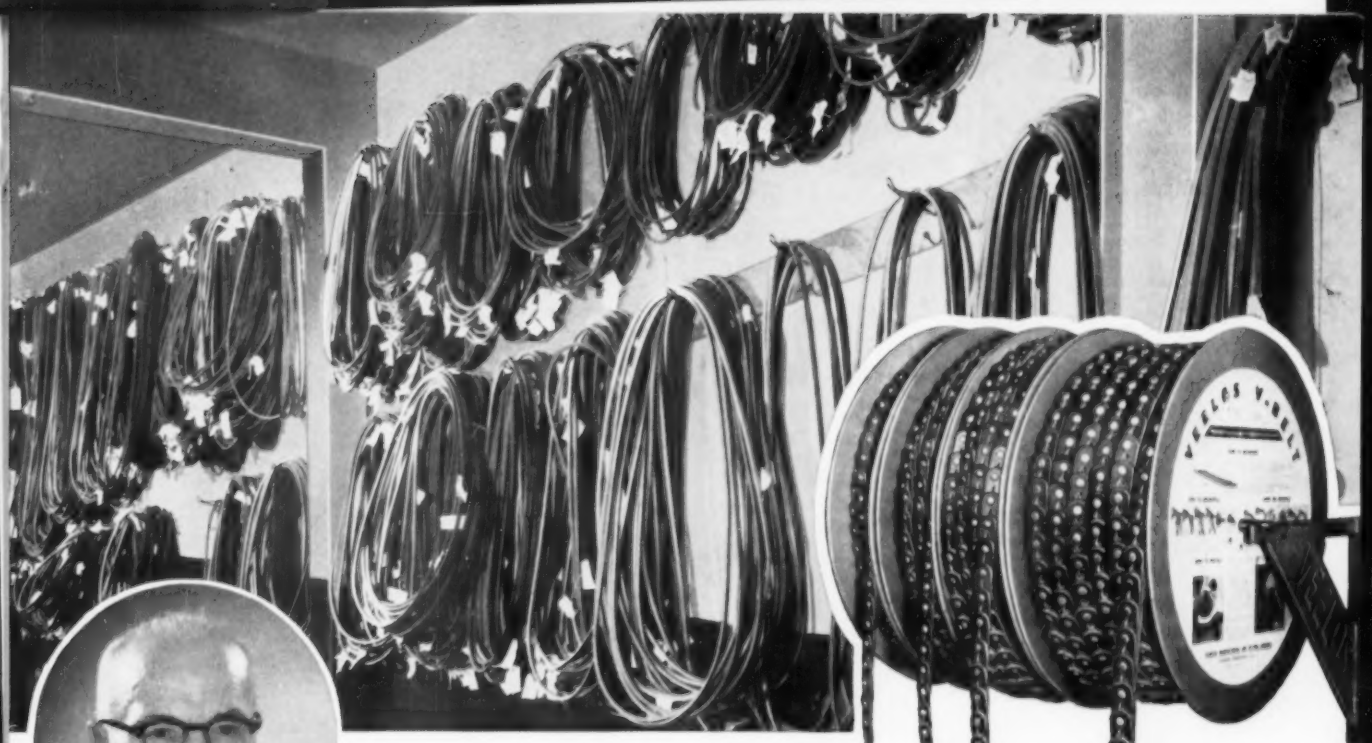

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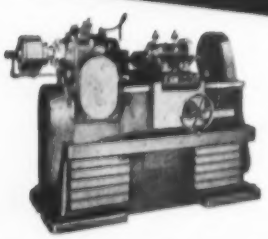

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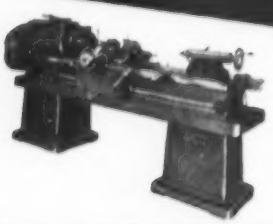

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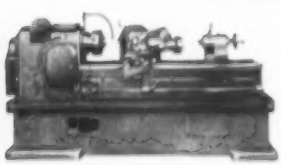

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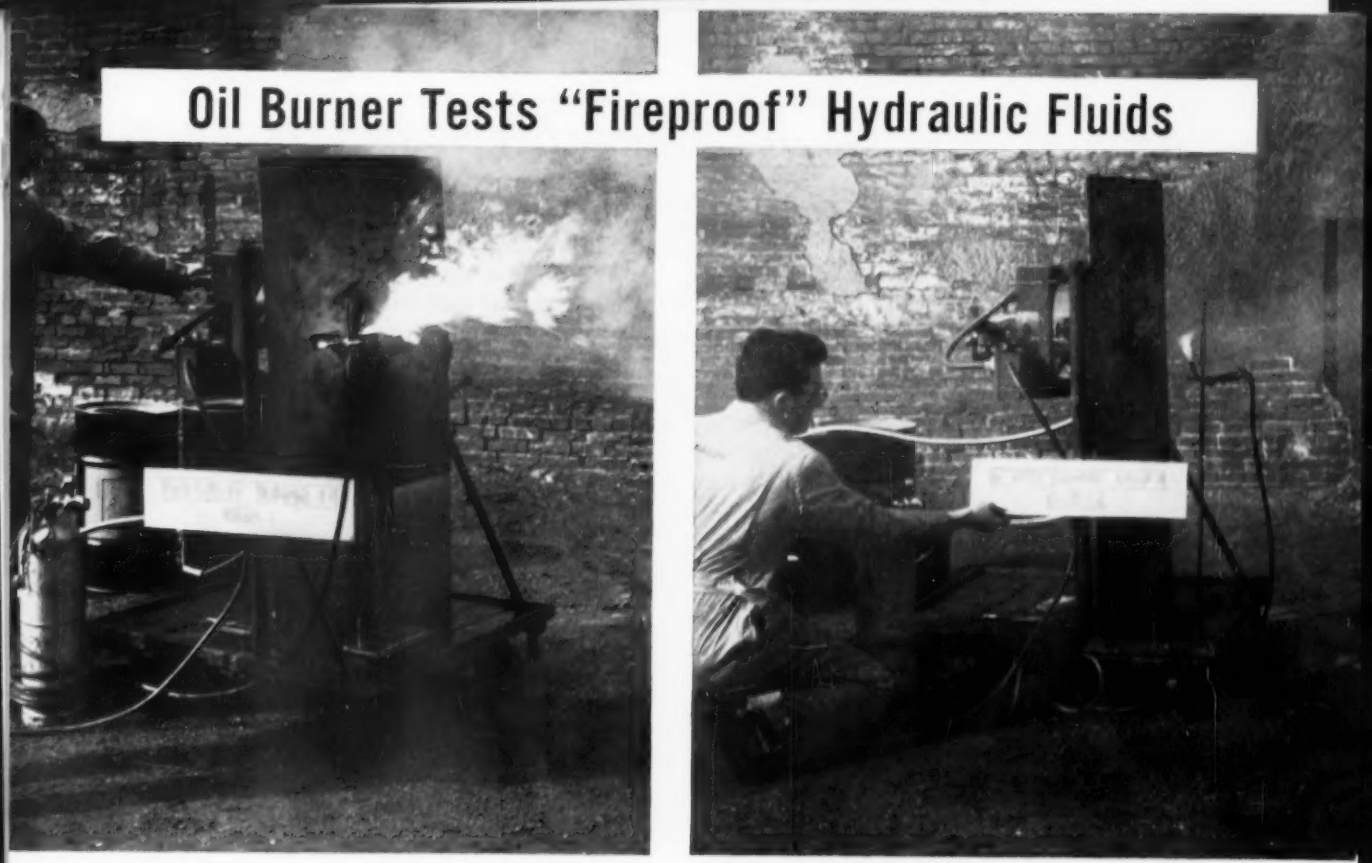

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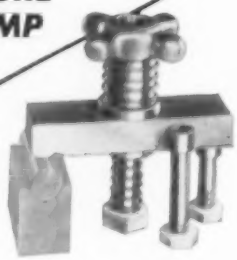

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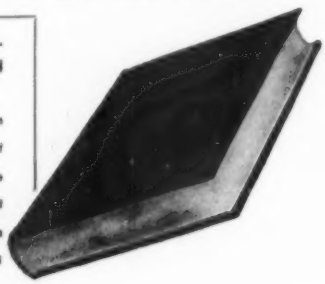

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the Surplus Machinery Market

Are used machine tools becoming a "hill and valley" business of peak winters and slow summers? And is this true of the new machine tool builders, too?

A lot of qualified people in both industries are beginning to think so. And this is borne out to some degree by the increasing tendency on the part of machine tool builders and rebuilders to shut down their plants for wholesale summer vacation periods.

At any rate, used machine tool sales across the country have dropped off considerably this year from winter and spring's high plateaus. And they'll probably continue to do so well into the fall. A quick, region-by-region survey of business conditions reveals that most dealers' business has dropped off about 30%. And the feeling is that customer firms did most of their buying for the year in the first quarter.

This seems to be because of a new trend on the part of metalworking firms toward wiser scheduling practices—that of making appropriations and want-lists in the fall for the following year so they can place big orders early.

In the big metalworking centers like Cleveland, top dealers report that their used machinery backlogs built up to as much as 10 months earlier this year, that customers were griping right and left that they couldn't get the machines they wanted when they wanted them.

But now new orders for used machines are slowing down rapidly, and while good machines are still tough to get, dealers are getting a chance to catch up with back orders.

One Cleveland dealer, who chalked up a record first quarter, was optimistic enough to do a little expanding. Today, he's pretty disappointed by an unlooked-for slowup in sales of almost every type of machine tool except precision boring mills, heavy structural and sheet metalworking equipment.

But two things could bolster the used machinery business in the near future. One is the current tightness of expansion and operating money, which may cause some the smaller manufacturers to reconsider tying up a big chunk of their capital for new machine tools.

The other is that there are indications you'll see more and more fine pieces turning up at government surplus sales, which are increasing in frequency—particularly in the eastern section of the country.

One dealer thinks that auctions are tending to get more and more out of bounds pricewise because of an increasing scarcity of new machine tools caused by the merger of small machine tool builders into larger firms. The big firms, he thinks, tend to either cut down on the small mergee's output, or channel it in other directions.

Availability of machine tools for rebuilding is still very slow across the country. There seem to be two primary reasons for this. The first is that metalworking companies don't like to tie them up for the necessary rehabilitation period at a time when they're making every effort to operate at capacity to take advantage of what metalworking boom there is left.

Another reason is that tremendous increases in the cost of repair parts are causing dealers to curtail their rebuilding activities drastically. One top Cincinnati rebuilder in consequence is doing repairs only for its own machines—none for outsiders in the last six months.

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Model 5-48 Cincinnati hydraulic duplex mill, new 1941.
Model 34-36 Cincinnati duplex mill, serial 3B33D14-4.
No. 74 Heald hydraulic plain internal grinder, w/cross-sliding H.S., new 1941.
No. 72A5 Heald hydraulic plain internal grinder w/extended bridge, new 1943.
No. 1-H-18 Kearney & Trecker simplex mill, late.
2000 Ton No. 6 National Maxipress, all steel frame.
7" No. 76H Baird Chucker, new 1943.
Pratt & Whitney Kellering Machines (5), one new 1941.
Model M24 Kearney & Trecker manufacturing mill, new in 1945.
16 Spdl No. D20H Natco multiple drill, 1943.
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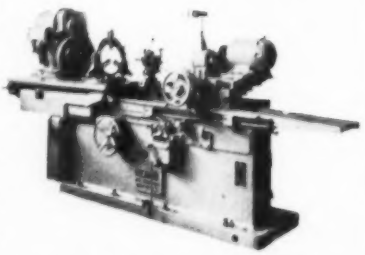
4" x 12" No. 4H Landis plain hyd. cylindrical grinder, 1943.
13" x 60" Hanchett vert. spdl. surface grinder, late.
126" x 96 ft. cc. Niles Bement Pond engine lathe.
15"x30" Lipe Carbo-Matic production lathe, 1942.
36" Rockford hydraulic openside shaper-planer.
36" Rockford hydraulic vertical slotter, new 1944.



(3) No. 72A5 Heald hydraulic internal grinder with extended bridge, serial No. 19331, new in 1943. Completely rebuilt and guaranteed.

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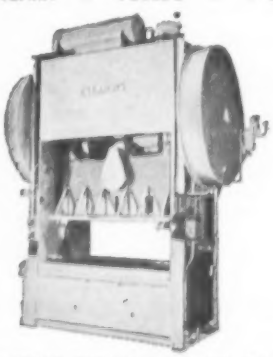

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Niles (Timesaver Model) 32"x14' Bed Grd. Hd. M.D. Lathe 7' Centers.
Niagara 4' Power Shear 14" Cap. 20" Gap
Ohio 24" M.D. All Grd. Feeds Shaper 1942 model
Cincinnati No. 8 Rect. Overarm Grd. Hd. Plain Horiz. Miller.
Baush 44" Vert. Boring Mill 2 heads
American Vert. Hyd. Broach 48" str. 15 ton cap. 1947
American 20"x8' Grd. Hd. Lathe motor in base.
Landis 20"x72" and 16"x96" Plain st. Grinder
Hanchett 25 H.P. Sp. Vert. Hydr. Surf. Grinder 12"x48" table
W&S No. 2-A Grd. Hd. Univ. Turret Lathe
Bliss 200 T Cap. S.S.S.C.B. Grd. Press 8" Str. #77
Rivett No. 104 A.C. M.D. Internal Grinder.
Milwaukee Nos. 2-B & 3-B Horiz. Plain Millers
DoAll 16" Job Selector Metal Saw.
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American 28"x27' Bed Grid. Hd. Lathe 20' Centers
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Barnes 20" All Grd. Camel Back Drill 1-Sp.
Blanchard M.D. Vert. Sp. Surf. Grinder 26" chuck.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Ret. Surf. Grinder 12" chuck 1942.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Handey 16"x8' bed Q.C.G. Lathe 1939.
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Foster 2-F Fastermatic Hyd. Turret Lathe.
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P & J #2 Auto. Prod. Miller, 2 Tables.
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36"x42" Pratt & Whitney Die & Surf.
30"x120" Hanchett Plane, Surf.
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16"x48" cen. Monarch, '42
20"x54" cen. Reed Prentice '43
TURRETS No. 2H10 Libby 10¼", '45
Nos. 2 & 3 B. & O. '43
No. 3 Gisholt Bar Chuck, '42
ROLLS, 10'x½" Bertsch Pinch '43
SHAPER, VERT., 12" Pratt & Whitney, 1942
SLOTTER, 36" Rockford Hyd. '44

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#4 Cincinnati Centerless Grinder #3M4H1K (Filmatic)
#3SL Excello Thread Grinder #1383
#39A Excello Internal and External Thread Grinder #9185
#55 Heald Horizontal Grinder #15429
Sundstrand Plain Duplex Milling Machine, Model #33FM18120, Ser. #96-265 (10 ft. table).
#5A Bryant Internal Grinder #K8732
40 K.W. Ajax High Frequency Converter with 30 lb. steel melting furnace #62014
2—918 Rivett Bench Lathes, #764 and #1027 (steel cabinets).
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Chicago No. 410-D Brake, NEW.
Gleason 3" Str. Bevel Gear Generator.
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K & T No. 3B Plain, MIB, 1925, vert. attach.

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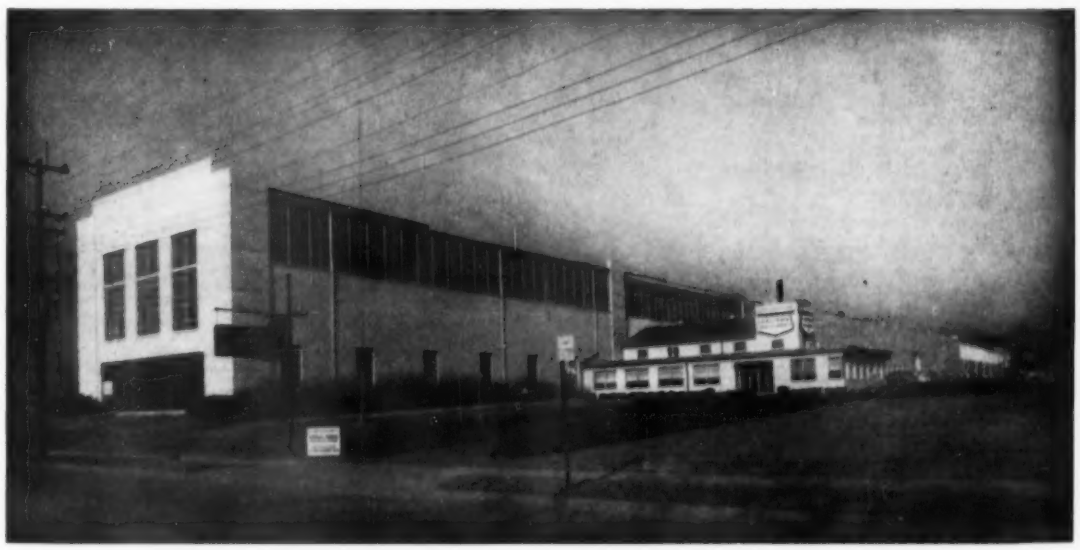

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12x33", 20"x25", Jones & Lamson Fay Automatic Lathes, 1944
12x18" Reid Small Piece Production Lathe, Model 6WSL, m.d.
No. 3 Lodge & Shipley Duomatic, m.d., late type
No. 3A Lodge & Shipley Duomatic, m.d., late type
W. C. Lipe Carbo-Semi-Automatic, m.d., late
No. 4 LeBlond Boring Lathe, 37' bed, 4" hole, m.d., latest
No. 9, 12 LeBlond Multi-Cut, m.d.
4x60" LoSwing, m.d.
8x132" LoSwing, m.d., latest
11x18" LeBlond Rapid Production, m.d.
12x18" centers Monarch Model 5T, m.d.
No. 12 Gisholt Semi-Special Automatic Production, m.d.
No. 9WSL, Reid Production Lathe
17"x39¾" LeBlond Mfg. Type Production Lathe
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No. 10 Sundstrand Automatic Lathe

HAND MILLING MACHINES

Van Norman, m.d., latest

PLAIN MILLING MACHINES

No. 1B Milwaukee, m.d.
No. 2 Rockford, m.d.
No. 2 Cincinnati Plain H.S. Dial Type, m.d.
No. 2B Brown & Sharpe, m.d.
No. 3B Brown & Sharpe, m.d.
No. 3B Milwaukee Plain, m.d.
No. 4B Brown & Sharpe Plain, m.d.
No. 3 Cincinnati Plain H.P., Dial Type, m.d.
No. 5 Cincinnati Plain H.P., m.d., late
No. 22L Van Norman Ram Type Swivel Head, m.d.

UNIVERSAL MILLING MACHINES

No. 3 Cincinnati, m.d., in base
No. 4A Brown & Sharpe Heavy Duty, m.d.
No. 4 Cincinnati High Power, m.d.
No. 2H Milwaukee, m.d.
No. 2MH Cincinnati, m.d., late

THREAD MILLING MACHINES

6x20" Type B Pratt & Whitney, Geared Head, m.d.
12x24" centers Lees Bradner Model HT, Heavy Duty, m.d.
12x36" Lees-Bradner Universal Type, m.d.
12x54" Lees-Bradner Universal Type, m.d.
12x102" Lees-Bradner Universal Type, m.d.
14"x16" U6 Automatic Hob, m.d.
No. 40 Lees Bradner Automatic Universal, m.d., late
Hall Planetary, m.d.

VERTICAL MILLING MACHINES

No. 1-14 Kent Owens, m.d.
No. 08 Cincinnati, m.d., latest
54" Ingersoll Single Spindle Adjustable Rotary Mill, m.d.
54" Ingersoll two spindle Rotary Mill, m.d.
No. 4 Cincinnati Vertical High Power, m.d.
Sundstrand Rigidmill, m.d., late
No. 2K Kearney & Trecker "Milwaukee," m.d.

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No. MM-1-6 U.S. Multi-Miller, m.d.
4" Pratt & Whitney Spline Miller, m.d.
18", 24" Cincinnati Plain Automatic, m.d.
24" Cincinnati Duplex Automatic, m.d.
No. 21 Brown & Sharpe Automatic, m.d.
48"x16' Newton Slab Miller, m.d.
48" Cincinnati Auto. Duplex Production Mill, m.d.
54"x30"x10' Ingersoll Slab Miller, m.d.
No. 1-18 Cincinnati Plain Automatic
No. 4-48" Cincinnati Tracer Controlled Duplex Hydromatic, m.d.
M80 Taylor & Fenn Duplex Spline Miller, m.d., latest type
Model 1402 Kearney & Trecker Simplex, m.d.
No. 33 Simplex Production Miller, m.d.

PROFILERS

No. 12 Pratt & Whitney
4 spindle 360 Cincinnati Automatic, m.d., 1954

SLOTTERS

10" Newton, m.d.
12" Bement-Miles, m.d.
15" Canada, m.d.
18" Betts Crank Slotter, m.d.
18" Niles-Bement, s.p.d.
20-24" Dill, m.d.
22" Betts, m.d.
48" Niles Slotter, m.d.

PLANERS

P10 Coulter Crank Type Shaper-Planer, m.d., 1 hd.
30"x30"x10' Cincinnati, belted m.d., 2 heads
30" widened to 36"x30"x8' Gray, belt drive
36"x36"x8' Cincinnati, m.d., 2 heads on rail
36"x36"x10' Betts, belted m.d., 2 heads on rail, 2 side heads
36"x36"x12' Betts, m.d., 2 heads
36"x36"x12' G. A. Gray, 3 heads
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' G. A. Gray Extra Heavy, belt, 2 heads on rail
36" widened to 42"x36"x20' Cincinnati, m.d., 2 rail heads, 1 side head
36"x36"x30' Cincinnati, m.d., 4 heads
42"x42"x26' G. A. Gray, 2 hds., belted motor drive
48"x48"x12' Cincinnati, 4 heads
48"x48"x18' Niles-Bement-Pond, 2 heads, belt
48"x48"x18' Detrick & Harvey, 4 heads, reversing m.d.
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6'17" AMERICAN Triple Purpose Radial Drill (older)
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No. 61A FELLOWS Gear Shaper (late)
No. 135 CLEVELAND AXLE Shaft Hobber
No. 36 BM GOULD & EBERHARDT 3-Spindle Bevel Gear Cutter
No. 36B GOULD & EBERHARDT Automatic Gear Cutter (late)
No. 725 FELLOWS High Speed Gear Shaper
No. 12 GLEASON Straight Bevel Gear Rougher
No. 60SM Gould & Eberhardt 3-Spindle Vertical Gear Cutter (nearly new)
Model A BARBER COLMAN Hobber

GRINDERS

No. 2 CINCINNATI Centerless Grinder—plain bearing
No. 5 BRYANT Internal Hydraulic Hole Grinder (late)
No. 16-16 BRYANT Hydraulic Internal Hole Grinder (late)
No. 16-38 BRYANT Internal Hydraulic Hole Grinder (late)
No. 24 P 26 BRYANT Hydraulic Internal Hole Grinder (late)
No. 50 HEALD Internal Grinder (late)
6' x 18" CINCINNATI Plain Cylindrical Grinder Type EA (saddle)
10"x18" NORTON Semi-automatic Plain Cylindrical Grinder (late)
10" x 48" LANDIS Plain Cylindrical Type C Grinder (late)
14" x 168" LANDIS Type CH Plain Cylindrical Grinder (late)
14" x 72" Plain CINCINNATI Self-contained Grinder
16" x 36" NORTON Type C Cylindrical Grinder
Model A3-16 ARTER Rotary Surface Grinder
Model 25A HEALD Rotary Surface Grinder
No. 16A2 BLANCHARD Automatic Surface Grinder
Model 76 RAP ROGERS Knife Grinder

MILLERS

No. 2 BROWN & SHARPE Plain Late Type Hi-speed Horizontal Mill
No. 2A BROWN & SHARPE Universal Horizontal Mill (older but good)
No. 4-48 CINCINNATI Hydro-matic Duplex Mill
No. 4 CINCINNATI Plain Horizontal Dial Type Mill

PLANERS

36" x 36" x 26' CINCINNATI Double Housing Hypro Planer (reversing motor drive)
48" x 48" x 10' GRAY Double Housing Planer (reversing motor drive)

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No. 1A WARNER & SWASEY Geared Head Way Type Turret Lathe (older type)
No. 2A WARNER & SWASEY Geared Head Way Type Turret Lathe (older)
No. 2L GISHOLT Geared Head Way Type Turret Lathe, hydraulic pre-selector
No. 5D POTTER & JOHNSTON Geared Head Way Type Turret Lathe (late)

MISCELLANEOUS

14" x 16" COULTER Automatic Screw Cutting Lathe (late type)
12" 8-Spindle BULLARD Mult-Au-Matic
6" x 60" Model C PRATT & WHITNEY Thread Mill
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- 36" x 240" Centers Niles Timesaver Engine Lathe. New in 1941.

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=5H K & T Horiz MILL w/vert head, 1942
=4H K & T Vert MILL 16 speed, 1943
=C225H Natco 12 spdl (adj.) DRILL, 1942
30" Rockford Openside SHAPER 2 heads
8 oz. HPM Inj. Moulding PRESS, New Contr.
75 KW Tocco INDUCTION Unit 3 Station, '44
22x84 Sidney H.D. 32 speed LATHE, 1952
CT-36 Lees Bradner Univ THREAD MILL, 1944
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27" x 18' MONARCH "N" Geared Head Lathe, 11' Centers, Taper Attachment, Full Equipment. Late Type. 1942.

24" x 36" BULLARD Vertical Turret Lathe, Turret Hd., Side Hd., M.D.

No. 2, 4, 6 WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

No. 2, 7 BARDONS & OLIVER Universal Turret Lathes, Preselector, Bar & Chucking. Late Type.

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36" CINCINNATI BICKFORD Upright Drill Press, P.F., M.D.

3', 4', 5', 6' CINCINNATI BICKFORD Radial Drills.

6 Spindle No. 2 LMS Leland-Gifford Drill Press. Late Type.

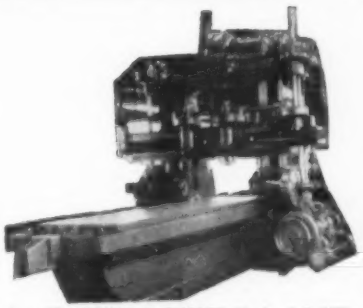
No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive. Late Type.

MILLS

#2B KEARNEY & TRECKER Univ. Horizontal Vertical Head. M. D.

No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late.

1A PRATT & WHITNEY Jig Borer, with Gauges, Rods, Collets and Chuck.



No. 2B BROWN & SHARPE Horizontal Mill, Motor in Base. Late Type.

42" by 36" x 12" INGERSOLL Planer Type Mill, two heads on rail, two side heads, M.D.

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No. 91-C TOLEDO Straight Side Double Crank Power Press, 27" x 36" Bed Area, 60 tons cap., M.D.

No. 8 BLISS CONSOLIDATED 90 Ton Cap., O.B.I. Geared. Air Cushion. M.D.

400 Tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support, M.D.

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No. 2 CINCINNATI Universal Tool & Cutter Grinder. Late Type.

4" x 12" LANDIS Hydraulic Plain Cylindrical Grinder, M.D. Late Type.

6" x 18" NORTON Hydraulic Horizontal Surface Grinder, Permanent Magnetic Chuck, Coolant System, Late Type.

No. 14 W HAMMOND Double End Carbide Grinder, M.D.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

41 SELLERS Tool Grinder, M.D. Late Type.

30" INGERSOLL Face Mill Cutter Grinder, M.D. Late Type

6" x 18" LANDIS Type "C" M.D. Hyd., Cylindrical Grinder, Serial #29196.

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MISCELLANEOUS

18 KW SCIENTIFIC ELECTRIC Induction Heater, Tube Type.

6' x 14 ga. WYSONG & MILES Shear

No. 6LS FELLOWS M.D. Gear Lapping Machine, Detachable Head, Univ. Work Support.

No. 1, 2, BUFFALO FORGE Vertical Angle Bending Rolls, M.D.

½, 1½ BUFFALO FORGE Universal Ironworker, Notcher and Coper, M.D.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, M.D. Late Type.

No. 6 BROWN & SHARPE Automatic Screw Machine, M.D., 2" Capacity.

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12" PRATT & WHITNEY Vertical Shaper, Keller Attachment. Late Type.

12" ROCKFORD Hydraulic Vertical Shaper. 1953.

15' x 10' x 36' BETTS Double Housing Planer, 4 Swivel Heads, Pendant Control, Box Table, Motor Driven.

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100" Niles vtl. Boring Mill — 1952 w/2 swiveling rail heads and side head, hydraulic feed. Main drive motor—50 HP.

27" Birdsboro Vtl. Boring Mill.

5" Univ. Horiz. Boring Mill, Hi-spd. w/thread, att.

10" Horiz. Boring Mill. (Used one year.)

8' x 18" Cinc. Tool & Die Mill w/depth control, 1952

DoAll Mod. 36 Hydro-feed Contour Saw, 1951

25" Monarch Mod. N Lathe. Factory-raised in sand to swing 36½"-48" oc w/air tracer, 1950.

2⅝ 6 spindle Cone (in use only 8 months) w/thread & Tapping, also Tooling.

7 #2&3 Cinn. Centerless Grinder w/Filmatic Bearings.

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10' x ¼" Cleveland Shear.

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16"x 96" Norton (Plain).

16"x 72" Norton (Plain hydramatic).

10"x 72" Landis (Plain).

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No. 4 Gisholt Universal Turret Lathe, A.C. Motor Drive, Auto Chuck & Bar Feed, Hyd. Speed Selector, Selective Gear Box for Threading Attachment, Loaded with extras. Serial 724-21, New 1941. Replacement Cost in Excess of $11,000. OUR PRICE $7,250.

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Foote-Burt Vert. 26" sw, new 1941
#49 Heald Borematic, new 1944

DRILLS

1 spdl, 14" sw, #2 Avey, new 1945
1 spdl, 20" sw, #2LMS L.-G., 1945
1 spdl, 24" sw, #2MA6 Avey, new 1942
1 spdl, 26" sw, #4MS L.-G. hydraulic
2 spdl, 24" sw, #3 Avey, AC MD.
3 spdl, 20" sw, #2LMS L.-G. 1942
5 spdl, 24" sw, #3MS L.-G. new 1943
4 spdl, 14" sw, #2LMS L.-G. new 1942
6 spdl, 20" sw, #1LMS L.-G. new 1943
#214 A Baker Univ. H.D., 1943
16 spdl, For #K50H, #2 taper, 1944

BORING MACHINES

Foote-Burt Vert. 26" sw, new 1941
#49 Heald Borematic, new 1944

GRINDERS

3"x12" #5 B&S, Rap. Trav., 1948
3"x18" #5 B&S Rap. Trav., 1943
4"x12" #4H Landis, 1942
4"x18" No. 4H Landis 1943
6"x18" Norton Type C, new 1942
10"x18" Norton Type C, new 1942
10"x36" Norton Type C, new 1942
10"x48" Norton Type C, new 1943
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
16"x72" Hill-Clarke, AC Mot. Dr.
16"x26"x72" Norton, AC MD. 1941
42"x72" Norton, extra, new 1947
18"x96" Hill-Clarke, AC Mot. Dr.
18"x120" Norton Grinder
24"x264" Norton, AC MD, Rebuilt
26"-32" Gap x 114" Norton Pl. Cyl
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-38 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Mizematic, 1944
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc, 1940
#3-B Abrasive Surf, 8"x24" Table 1943
#18-30" Blanchard Rot. Surf.

LATHES

16ML-16"x36" LeBlond Auto.
#16ML-16 LeBlond, Semi-Auto. 36" oc
14"x36" Amer. Grd. Hd., MD
27"x84" Amer. Grd. Hd., MD
24"x42" Fay Auto. AC MD
36"x120" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36" 1942
120"x96" oc N-B-F, ser. 3380
#5W Cinn Acme Univ. Turret
#4 Gisholt Univ. Tur., A C & B F.
#3AL Gisholt, cross-slide Tur, 1941
#3H-10 Libby H.D. Tur. 1942
#6A W&S Turret, new 1944
42"H Fasternatic, tur. 33" sw. 1944
#8B Potter & Johnston, new 1941

MILLERS

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54"x8' Ingersoll Openside, 1942
54" Ingersoll Vertical Rot.
#9V Davis & Thompson Vert., 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B Thread Mill
#CT L-B Thread Mill new 1942
No. 2 Cinn. Univ. Hi-Power
#36 Van Norman, Rebuilt, 1941
#1-18 Van Norman Fred. 1942

PLANERS

36"x36"x12' Rockford Openside '43
60"x48"x27' American, 4 hds.
60"x48"x30' Hamilton, 4 heads

MISCELLANEOUS

6" Gun & DeLeeuw 6 spdls. 1941
#306 Barnes Vert. Hone, new 1943
15 Ton Hyd. American Press, 1948
#11BD 2 Hd. W&S Tapper, latest
#36RM G&E 3 Spdl. Bevel Gr.
#61A Fellows Gr Shaper, 18" cap.
#5A Kaufman Prod Tapper, 1947
#HR8 Barber-Colman Sharp Mach.
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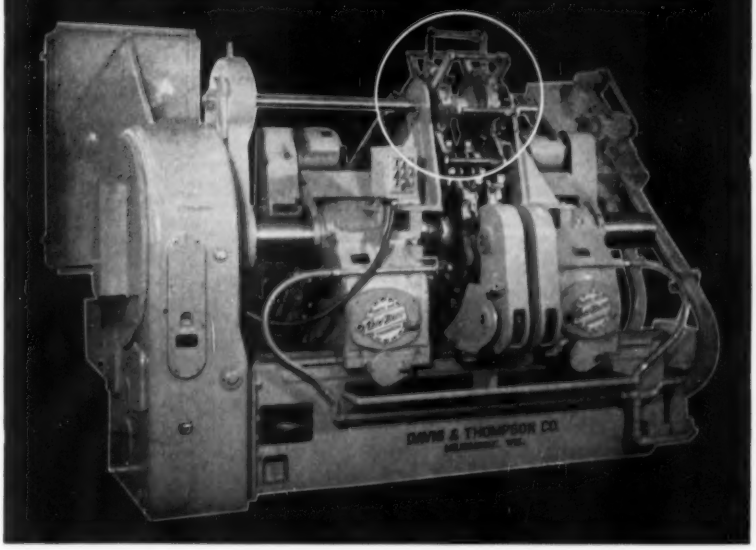

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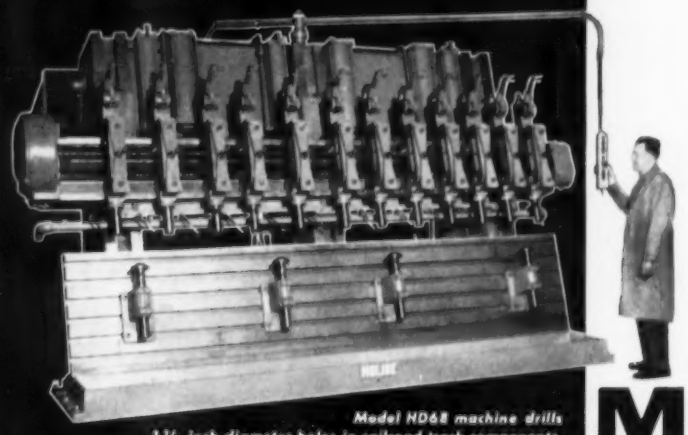

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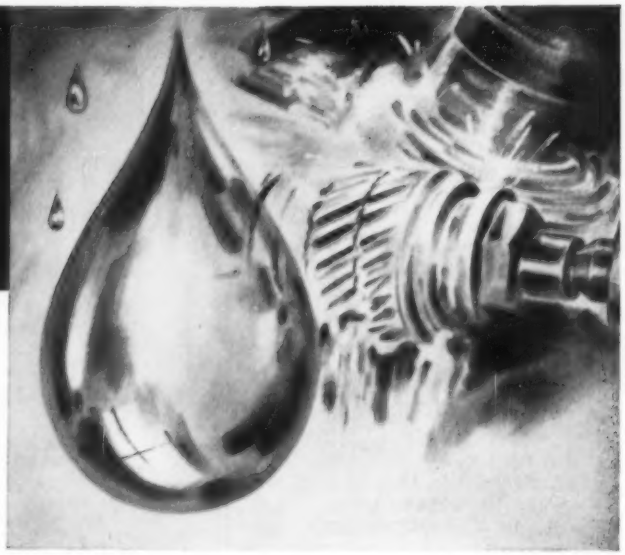

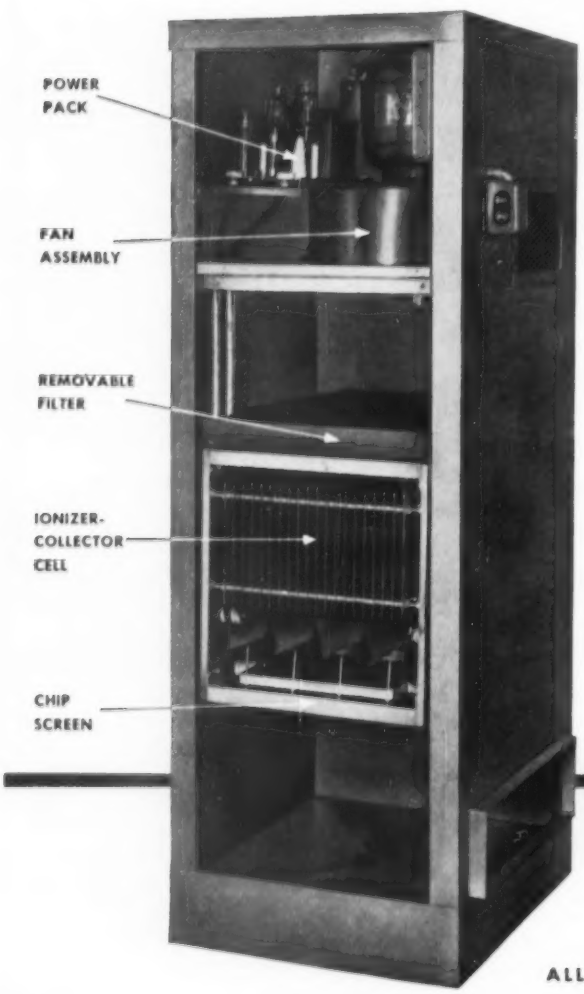

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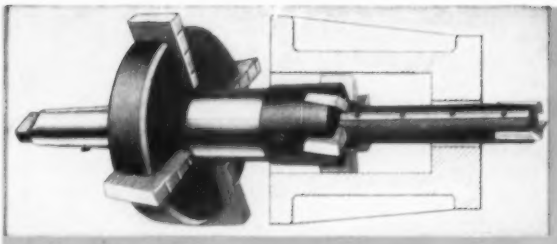

Fig. 1. Double boring and facing head

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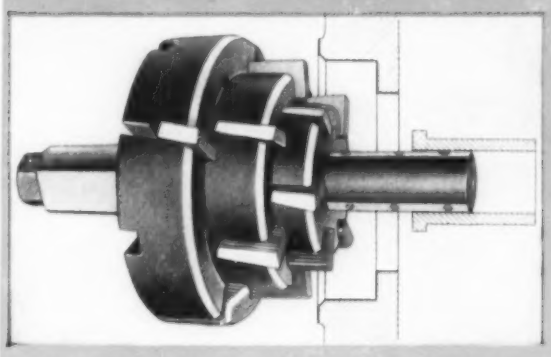

Fig. 2. Double boring, facing and chamfering head with strip pilot

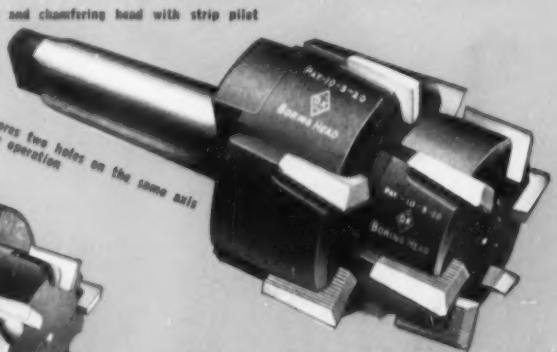

Fig. 3. Double boring head bores two holes on the same axis in one operation

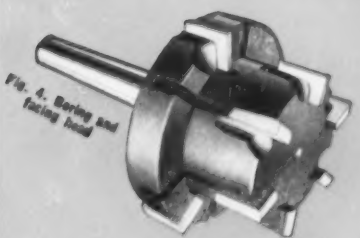

Fig. 4. Boring and facing head

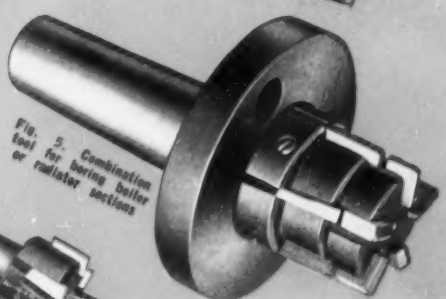

Fig. 5. Combination tool for boring bolter or reamer sections

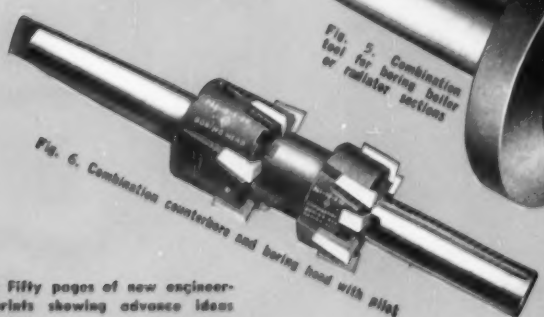

Fig. 6. Combination counterbore and boring head with pilot

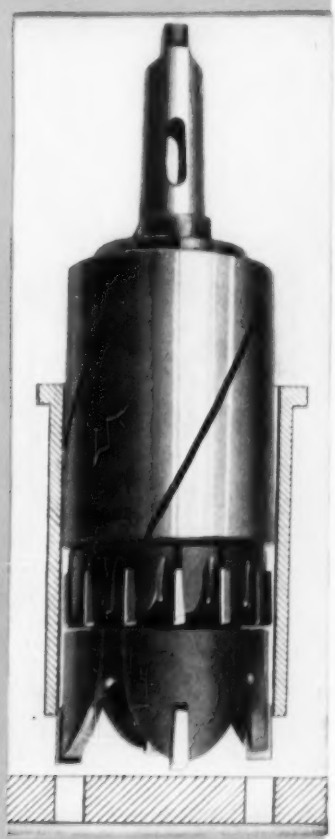

Fig. 7. Piloted trepanning and reaming head

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